Suggested Math Strategies for RTI²

Provide many opportunities for multi-sensory learning

If a student...	then...
struggles with **number sense** (foundational math skills) skills in the following areas... *number ID *missing number *quantity discrimination *number representation *place value	**Activities** ☐ **manipulatives for number sense practice** using a variety of textures (use sand box/tray, sand paper, shaving cream, Magnadoodle, dry erase board, Wikki sticks, magnetic numbers, play dough, Unifix cubes, Base 10-blocks, place value mats, counters, small plastic animals, beans, 100 chart, ten frames, etc...) ☐ **roll a number cube**, student/teacher calls out the number rolled. (Students who don't know the number will learn by seeing and hearing the number called.) ☐ **locate/match** word or numerical numbers using magazines, newspapers, task cards, etc... ☐ **organic number line**-show different ways to represent the number (numerically, pictures to represent number, tally marks, etc...) ☐ **missing number chart**-fill in missing numbers ☐ **number of the day**-write the number in air, trace and say it, write it on chart/paper, hit it/say it on the way out the door ☐ **graphic organizers**-(i.e. place value chart, "roll before and after", "before-between-after", place value cards, etc...) ☐ **place value mats**-serves as a prompt to reinforce math concepts and skills. Example: organize objects by tens/place value concept ☐ **flashcards** for students to practice number ID fluency ☐ **deck of cards**-practice number ID, practice value of number, practice add/subtract to 10 ☐ **decompose numbers**- Ziploc baggie activity-draw a line down middle of baggie, write a number (5-20) at top of bag, place gel and that number of marbles in baggie, ask students to write math number combinations representing that number; use story math mats, use ladybug math mats, etc... ☐ **count up strategy**-student names two methods for answering a math fact..."know it or count up" ☐ **hundreds pocket chart** -select 3 numerals and 3 students. Ask each student to place his/her numeral in its correct pocket and to explain the strategy they used to help them complete this task. Repeat the above with 3 numbers and 3 students per day until all pockets are filled. Take note of students who use a count by one strategy and those who demonstrate an awareness of the base ten patterns underlying the chart. Select numbers based on your knowledge of individual student's number sense (e.g. you may select a number immediately before or after a number that is already on the board for one child and a number that is 10 or 11 more than a placed number for another child who you feel has a good understanding of the base ten pattern)

Updated: 5/27/14

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If a student...	then...
(cont.) **number sense**	☐ **100 chart cover up**: Students shuffle the set of number cards and place them face down. Draw 2 cards and makes the least and the greatest two digit numbers that they can with the cards drawn. (ex. 7 and 3 would be 37 and 73). The students color in the appropriate boxes on their own hundreds chart. Players 2 goes next. Players continue until one of them colors three boxes in a row. ☐ **10 less, 10 more, 1 less. 1 more**: Student rolls a dice and puts the number in the center box. They then need to find the numbers that would be 10 less, 10 more, 1 less, 1 more than the number rolled. Students may refer to their hundreds chart. Discussion should take place about the patterns you see. ☐ **vice-versa**: Write a 3,4,5,6,or 7 digit number on the board and have students repeat it. Erase the number. Have students build the number using their place value strips. Repeat with as many numbers as possible. Make sure to include numbers that have 0 in one of the places. ☐ **show me**: Ask each student to make a Place Value Chart on their paper by dividing it into appropriate number of columns (ex 3 columns if doing hundreds, tens, ones) Say a number and ask the students to build that number. Ask the student to write down the number. Ask questions such as how many tens does this number have? What is the value of the __ in this number? What number is in the hundreds place? ☐ **What's my number?**: Have Students Create a 3 , 4 or 5 digit number of their choice. Ask them questions such as What would my new number be if I added 10? Record it. What would my number be if I subtracted 100? Record it. ☐ **shrink it**: Write a number on one side of each index card. Let's say you choose 1,345. On the other side, write the same number in expanded notation. Have a student select and index card, expanded notation side up, and create the number in standard form with their Place Value Strips. They can flip the card over to check their answer,make any necessary corrections, read the number aloud, and then select a new card. ☐ **multiply and conquer** Students decompose 2-digit numbers, model area representations using the distributive property and partial product arrays, and align paper-and-pencil calculations with the arrays. The lessons provide conceptual understanding of what occurs in a 2-digit multiplication problem. Partial product models serve as transitions to understanding the standard multiplication algorithm. ☐ **a meter of candy** in this series of 3 hands-on activities, students develop and reinforce their understanding of hundredths as fractions, decimals, and percentages. Students explore using candy pieces as they physically make and connect a set/linear model to area models.

Updated: 5/27/14

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If a student...	then...
(cont.) **number sense**	☐ **Online Resources** *EasyCBM (www.easycbm.com) *Intervention Central (www.interventioncentral.org) *Base 10 Shark Numbers www.ictgames.com/sharkNumbers_v2.html *Number & Operations (National Library of Virtual Manipulatives) www.nlvm.usu.edu/en/nav/category_g_1_t_1.html *Base 10 Blocks www.learningbox.com/Base10/BaseTen.html *Base 10 Fun www.abcya.com/base_ten_fun.htm *Mathwire (www.mathwire.com) *K-5 Math Teaching Resources (www.k-5mathteachingresources.com/ECAM.html) ☐ **iPad apps** *Montesorri Numbers Math Activities for Kids: Skills: basic math foundations, number sense, number ID *Native Numbers: Skills: number concepts, number relations, number ordering, counting, consolidate and integrate learning of concepts *Hands-On Math: Interactive Number Sense: Skills: ordering and comparing whole numbers, locating whole numbers on a number line *Math: Splash Math Series Skills: number ID, counting, base ten blocks, number line, ten frames *Number Line and Number Pieces Skills: helps students develop a deeper understanding of place value while building their computation skills with multi-digit numbers. Students use the pieces to represent multi-digit numbers, regroup, add, subtract, multiply, and divide. **Other Resources** *Kathy Richardson books: (Combination Trains, Hiding Assessments, Grouping 10's, Two Digit Addition and Subtraction) *Math Reasoning Inventory- www.mathreasoninginventory.com *MATH TALK: Teaching Concepts & Skills Through Illustrations & Stories, Forten & Richards, 2009.

Updated: 5/27/14

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struggles with **computation skills** (mathematical calculations) in the following areas... *addition *subtraction *multiplication *division *integers *mixed computation skills *positive and negatives numbers *fractions	☐ **Activities** ☐ **manipulatives** (base 10 blocks, Unifix cubes, money/coins, fraction bars, rulers, number lines, tiles, 100 board/chart, dice, part whole mats, counters, numeral cards, two sided color counters, math fluency cards, hundreds chart, small portion plastic cups, large rubber bands, food, kinesthetic movement, number grid, array, fraction fringes, die cuts (Teacher Center), Dinah Zike math foldables, geoboards, graph paper, fraction dice, etc...) ☐ **number talks**-a short, ongoing (5-15 min.) daily routine that provides students with meaningful practice with computation. It develops computational fluency ☐ **dart board problems** (with number 10-outer circle then 25 then 50 and 100 being the bullseye. Example problem: "Sammy throws 3 darts in the outer ring, one in the next ring and one at the bullseye. What is his score? or "Susie throws 6 darts and earns a score of 150. Where might the darts have landed?" ☐ **dot card addition** turn over a numerical card and find two dot cards that equal the numerical card ☐ **Unifix towers** roll two die and build a Unifix cube tower (two colors) to match the total. Write a math equation to match the cube tower. ☐ **part-whole mats** choose a numerical card and place above mat. Make different pairs of numbers to equal the numerical card above the mat. Use pictures, numbers or words to record work. ☐ **shake five and spill** shake five counters (two sided color counters) in a cup and spill on table. Record the number combinations for a number. Discuss the different ways to show the number in two sets. ☐ **math fact fluency sheet** student records math fact fluency goal and then progress monitors his/her progress http://www.k-5mathteachingresources.com/support-files/fact-fluency-record-sheet.pdf ☐ **pattern blocks** for fractions and geometry ☐ **division spin** Take turns spinner a spinner and divide the number you land on by five. Complete the math talk sentence and cover the answer on the game board with a counter. (___ dividedby 5 equals ___.) Play until one player has used all 20 counters. ☐ **hundreds chart** add, subtract and find patterns ☐ **lattice** (incorporating place value), box-and-cluster, and partial-products (using expanded form!) for multiplying large numbers. (bigger than a 1 by 1).

Updated: 5/27/14

Suggested Math Strategies for RTI²

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If a student...	then...
(cont.) **computation skills**	☐ **bean counting and ratios** using sampling from a large collection of beans, students get a sense of equivalent fractions, which leads to a better understanding of proportions. Equivalent fractions are used to develop an understanding of proportions.This lesson can be adapted for lower-skilled students by using a more common fraction, such as 2/3. It can be adapted for upper grades or higher-skilled students by using ratios that are less instinctual, such as 12/42 (which reduces to 2/7). ☐ **paying for your wheels** students consider the costs of owning a car and ways to lessen those costs. In particular, highway and city mileage are considered, and optimal mileage is calculated using fuel consumption versus speed data. ☐ **free ride** Explore fractions using the context of a bicycle and gear ratios. ☐ **walk to the movies** students measure their speed walking in a hallway and predicting how long it takes them to get to the local movie theater 3 miles away. This is an open-ended problem in which students must develop a strategy on how to collect the data, how to convert the data to MPH, and finally make a prediction. In addition to reasoning skills, students will practice unit conversion, prediction, proportions, and graphing. ☐ **Drop Zone: Adding fractions with like and unlike denominators utilizing strategy** students will play card and computer games by adding fractions to make 1. Students will determine how the fractions are related, by first determining what they have and then how much more is needed. Through different interactive games, students will utilize their skills and build upon them to expand their understanding of fractions. Students will be able to determine common denominators and other strategies to add fractions with like and unlike denominators. ☐ **fractional clothesline** a string will be stretched across the classroom and various points will be marked for 0, 1, 2, 3, and 4. This number line will be used to show that all proper fractions are grouped between 0 and 1, and that improper fractions or mixed numbers are all grouped above 1. Students clip index cards with various proper fractions, improper fractions, and mixed numbers on the clothesline to visually see groupings. Students then play an estimation game with groups using the same principle. ☐ **Zip, Zilch, Zero** Positive and negative numbers become more than marks on paper when students play this variation of the card game, Rummy. Engaged in a game involving both strategy and luck, students build understanding of additive inverses, adding integers, and absolute value. ☐ **1" graph paper** for area and perimeter and arrays ☐ **regular and fraction dice** to build fluency

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If a student...	then...
(cont.) **computational skills**	**Online Resources** ***Math Perspectives**-(www.mathperspectives.com) ***Intervention Central** (www.interventioncentral.org) * **National Library of Virtual Manipulatives** (www.nlvm.usu.edu/en/nav/category_g_3_t_1.html) * **Study Island/web tutorials** (www.studyisland.com) * **Kahn Academy videos** (www.kahnacademy.org) * ***K-5 Math Teaching Resources** (www.k-5mathteachingresources.com/ECAM.html) **and** http://www.k-5mathteachingresources.com/support-files/fact-fluency-record-sheet.pdf * **Illuminations-**http://illuminations.nctm.org/ * **NCTM-National Council of Teachers of Mathematics** http://www.nctm.org/resources/content.aspx?id=17109 * **Adapted mInd** http://adaptedmind.com * **Greg Tang Math** http://www.gregtangmath.com **iPad apps** * **Hands-On Math: Interactive Number Sense**: Skills: comparing whole numbers, decimals, and fractions; adding subtracting, multiplying and dividing whole numbers, fractions and decimals ***Number Bonds: Multiplication & Division**: find missing product-numbers 0-20; choose missing factor; number bond with missing factors ***Marble Math**: Skills: addition, subtraction, multiplication, division, fractions, Roman numerals, decimals, negative numbers, and more ***Mystery Math Town**: Skills: addition, subtraction, multiplication, and algebraic thinking ***Number League:** Skills: addition, subtraction, multiplication, and negative numbers ***Fractions Explained:** a humorous method of learning fractions using funny and well-planned videos. ****Fraction Monkey:** Practice adding, subtracting, multiplying and dividing fractions, "an educational angry birds" for fractions. **Other Resources** ***Number Talks Helping Children Build Mental Math and Computation Strategies--A Multimedia Professional Learning Resource**. Math Solutions, 2009 ***Navigations Series** (National Council of Teachers of Mathematics) The Navigations series focuses on topics that emphasize the importance of incorporating the Principles and Standards into your mathematics curriculum. Each book includes activities, lessons, worksheets, and a CD-ROM with additional resources for grades PreK-12th grades

Updated: 5/27/14

Suggested Math Strategies for RTI²

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If a student...	then...
struggles with **mathematical reasoning skills** in the following areas... *evaluate mathematical situations *select problem solving strategies *draw logical conclusions *develop and describe solutions *recognize how solutions can be applied	**Strategies/Activities** **manipulatives** (base 10 blocks, Unifix cubes, money/coins, fraction bars, rulers, number lines, tiles, 100 board/chart, dice, part whole mats, counters, numeral cards, two sided color counters, math fluency cards, hundreds pocket chart, small portion plastic cups, large rubber bands, food, kinesthetic movement, number grid, array, fraction fringes, die cuts @ Teacher Center, Dinah Zike math foldables, protractor, color algebra tiles, pattern blocks, etc...) **close read the prompt**--students must understand fully what they are being asked to do in order to accurately solve the problem **turn the math question or command into a 'to do' list** students can attend to all parts of the task -**create norms or expectations for students** to use as a reference when solving problems -**use journals**--half of the journal as a 'reference' section where students keep notes on new concepts, expectations for task completion, and/or example problems;turn it upside down and use the other half to solve tasks -**explicitly teach the math practices** create expectations for each math practice and model, model, model, these expectations -**accountable talk** must be implemented-ask teachers to watch another teacher model AT, then work with coach or PLC to create bridge to practice tasks to help effectively implement **develop rubrics for math tasks** based on expectations for tasks completion institute the **'no naked numbers' rule** requiring students to always label numbers **write explanation without using numbers** Example: I took the number of students who got on the bus at stop one and added it to the number of students who got on the bus at stop two and I got the total number of students on the bus. have students **analyze problems** for errors and explain why problems are incorrect. If you can explain what it's not, then you know what it is. -teach **from concrete to pictorial to abstrac**t-- leads to true conceptual understanding. discuss **relationships among math operations**-help students understand relationships between addition and subtraction or multiplication and division or the place value system.

Updated: 5/27/14

Suggested Math Strategies for RTI²

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If a student...	then...
struggles with **mathematical reasoning skills** in the following areas...	☐ **today's number is** Select a number for the day (e.g. 8) and write it on the board or chart paper. Ask students to suggest calculations for which the number is the answer. Write students' suggestions in 4 columns (addition examples, subtraction, multiplication and division). After 8 or 10 responses, focus in on particular columns or types of responses that you would like more of. For example,"Give me some more addition examples", "Give me some ways which use three numbers", "Give me an example using parentheses" etc. ☐ **angle barrier game** Work with a partner. Sit side by side with a divider standing between you. Player 1: Using a protractor draw and label an angle in each space on your grid without letting your partner see your work. Player 1: Give instructions to your partner on how to draw angles to match your grid. Use the names and measures of the angles, along with positional language to describe where to place them. Remove the divider and look at the two grids to see how closely they match. Swap roles and play again. ☐ **football finances** students analyze pictures of football stands to make estimates related to the attendance at the Super Bowl. The students will realize that estimates must, at times, be made with little background information and that a range of answers might be correct. Students also make estimates about the television audience. ☐ **multiplying integers using videotape** students experience beginning-algebra concepts through discussion, exploration, and videotaping. The concept of multiplication of integers is presented in a format which encourages understanding, not simply rote memorization of facts. ☐ **Singapore Math Model Drawing** for problem solving all operations with whole numbers, fractions, etc. ☐ **jump ropes with clothes pins** to plot fractions on a number line

Updated: 5/27/14

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If a student...	then...
(cont.) **mathematical reasoning skills**	☐ **power up** Using old batteries and a voltage sensor, students get a real feel of the meaning of negative and positive numbers. Students explore addition of signed numbers by placing batteries end to end (in the same direction or opposite directions) and observe the sum of the batteries' voltages. ☐ **Popcorn, anyone?** used for students to discover the relationship between dimension and volume. Students create two rectangular prisms and two cylinders to determine which holds more popcorn. Students then justify their observation by analyzing the formulas and identifying the dimension(s) with the largest impact on the volume. ☐ **Count on math: Making your first million** students attempt to identify the concept of a million by working with smaller numerical units, such as blocks of 10 or 100, and then expanding the idea by multiplication or repeated addition until a million is reached. Additionally, they use critical thinking to analyze situations and to identify mathematical patterns that will enable them to develop the concept of very large numbers. ☐ **fun with baseball stats** students explore statistics surrounding baseball. They are exposed to connections between various mathematical concepts and see where this mathematics is used in areas with which they are familiar. ☐ **real estate tycoon** students design, "build," and "sell" a house; after which they simulate investment of the profits in the stock market. Along the way, students make scale drawings, compute with fractions and decimals in various contexts, and even solve simple equations. ☐ **paper pool game** students develop their understanding of ratio, proportion, greatest common divisor, and least common multiple. ☐ **taking its toll** students will compare the price of a toll to the distance traveled. Students will investigate data numerically and graphically to determine the per-mile charge, and they will predict the cost if a new tollbooth were added along the route. ☐ **growth rate** Given growth charts for the heights of girls and boys, students will use slope to approximate rates of change in the height of boys and girls at different ages. Students will use these approximations to plot graphs of the rate of change of height vs. age for boys and girls. ☐ **talk or text** students compare different costs associated with two cell phone plans. They write equations with 2 variables and graph to find the solution of the system of equations. They then analyze the meaning of the graph and discuss other factors involved in choosing a cell phone plan.

Updated: 5/27/14

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If a student...	then...
(cont.) **mathematical reasoning skills**	**Online Resources** *Math Perspectives-(www.mathperspectives.com) *Intervention Central (www.interventioncentral.org) * National Library of Virtual Manipulatives (www.nlvm.usu.edu/en/nav/category_g_3_t_1.html) * Study Island/web tutorials (www.studyisland.com) * Illuminations-http://illuminations.nctm.org/ * NCTM-National Council of Teachers of Mathematics http://www.nctm.org/resources/content.aspx?id=17109 * Figure this! http://figurethis.org/index.html * Braining Camp math topics that have narrated lessons, virtual manipulatives, question sets, real world problem sets, and challenge modes. http://www.brainingcamp.com * portaportal www.portaportal.com (Kim Day and Cindy Cliche) **iPad apps** *Math Doodles: The mathematical puzzles allow users to play, explore, and experiment with mathematical concepts, while developing and strengthening their strategy and problem solving skills. The challenges are designed to allow for multiple solutions and strategies. *Symmetry Shuffle: Spatial reasoning and geometry are important elements of mathematics. Mathematicians use symmetry and geometric modeling to analyze mathematical situations and solve problems. **Other Resources** Good Questions for Math Teaching: Why ask them and what to ask (grades 5-8) Schuster, Lainie & Anderson, Nancy C., Scholastic, 2005. Math Projects K-2 (contains 27) and Math Projects 3-5 (contains 39) projects designed to provide opportunities for students to solve problems, develop math concepts and strategies and communicate their math thinking and understandings. Send home one project a month and provide valuable opportunities for parents to become involved in their child's learning. (http://www.k-5mathteachingresources.com/math-projects.html)

Updated: 5/27/14

Suggested Math Strategies for RTI^2

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Updated: 5/27/14