Full Transcript of:
Montessori Mathematics Materials Presentations

Introduction to Montessori Math Demonstrations (Disclaimer)

This program is intended to give the viewers a general understanding of the presentation of Montessori materials to children. It is not intended as a course in The Montessori philosophy or background of each material.

The materials of themselves do not constitute the Montessori method. Those trained in the Montessori philosophy understand that the materials are secondary to the principle of developing independence through freedom of choice. It is this brain-driven developmental urge which the adult is trained to observe and support. With that training, the adult links the child to the self-teaching materials which match her interest.

A complete knowledge of the materials and their function requires a certified Montessori Education Program which traditionally requires at least a year of training and internship.
Montessori materials are usually presented at a child-sized table, or on the floor. Floor materials require a rug to differentiate the material from the surrounding space and to provide an orderly environment in which to work.

Overview of the Demonstrations

The Montessori environment should be beautiful. Materials are designed to be colorful and pleasing to the eye. Whenever possible the materials stimulate the child's sense of touch, hearing, and even his taste or smell to maximize learning.

The materials are presented in a carefully planned order that provides the child with new challenges when he is ready to take them on. A new material may provide new small muscle challenges or more abstract thinking. The teacher's role is to observe when the child is ready and introduce new work accordingly.

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The emphasis in a Montessori classroom is the love of learning. It is not important that a child learn faster than his classmates. Every child works at his own pace, moving on when he is ready. When a child is working, he is rarely interrupted. By giving the child control of his own work, Montessori makes learning a powerful experience that keeps the child motivated. Montessori children love learning because it is fun, it is beautiful, it is age appropriate, and is designed to meet their needs.

1. Geometric Solids – Three Period Lesson

Math vocabulary can be taught with what Montessorians call "the Three Period Lesson."

In this case, she will demonstrate a three period lesson on Geometric Solids.

In the first step or period, the teacher *identifies* each solid as she lays it out. This is the ovoid. This is the cylinder. This is the cube.

The second step of the three period lesson is to ask the child to show you the solid when asked. “Where is the ovoid?” the teacher asks. The child points to the ovoid. “Show me the cylinder.” The child points to the cylinder. Show me the cube.

The teacher mixes up the solids and practices again with the child, using the second step in the three period lesson.

Finally, in the third period or step, the teacher asks the child, “What is this?” and the child will respond. “This is the cube”, verifying that the child has absorbed the information presented.

The three period lesson is frequently used to make learning new words fun. The teacher is able to observe the child and move ahead to the next step when he is ready.

2. Red and Blue Rods

The concept of comparative length is introduced with the Red Rods materials in the sensorial curriculum.

The Red and Blue Rods, or Number Rods, initiate the mathematics materials.

Ten rods, alternate in color to indicate units from one to ten. This material increases the level of abstraction by identifying length in units one-to-ten.

Each rod is laid own slowly in descending order.

The first rod is one. The child says one. The second rod has two units, the child counts one, two and so on.

The rods provide a visual and tactile representation of comparative length and the first sense of the meaning of numbers.

Like most Montessori materials, the Number Rods have a control of error that allows the child to identify a mistake and correct it without the assistance of the teacher. In this case, you can see that the rod is out of place and the child can correct it as needed.

Young children love repetition and will repeat a material often until they are satisfied that they mastered the concepts. With the Number Rods, they may discover variations of their own as they repeat the material.

3. Sandpaper Numbers

The Sandpaper Numbers provide the child with an opportunity to feel the number as he begins the visual process of recognizing the numeral and the physical process of writing it.

Like all Montessori materials, the sandpaper numbers are beautiful and stimulate the child’s senses to maximize learning.

The teacher sits on the child’s dominant side when presenting a lesson. If the child is right handed, the teacher sits to his right to ensure that the child’s perception of the lesson is optimized.

The teacher takes each number out of the box and traces it two or three times with her finger. Then she gives the child the opportunity to trace the number. After the child is familiar with the number, the teacher repeats the process and says the number aloud.

4. Number Rods and Cards

Each new material provides a new level of abstraction. The next step is to combine the Number Rods and Number Cards. The child lays out the rods and correctly labels each rod with the appropriate number. The



concrete representation of the numbers one-to-ten are now represented by the abstract symbol learned with the sandpaper numbers.

5. The Spindle Box

The Spindle Boxes introduce the concept of zero to the child for the first time. It also demonstrates all the digits used in the base 10 system of numbers.

The teacher indicates that no spindles go into the zero box, that one goes into the one, two into the two and so forth. Each number is counted out in the hand to provide a tactile and visual sense of the number. At the conclusion of the counting process, the child bundles the spindles together with string or rubber bands to emphasize the quantity represented by each number as a set.

6. Cards and Counters

Ten individual numbers or cards accompanied with small discs give the child the opportunity to count out the discs to match each number. The teacher lays out the material for the child as shown here. The concept of odd and even is introduced with the demonstration of how the odd number of discs block the finger, while the even number allows it to pass. At the end, the even numbers can be counted at the top, and the odd numbers can be counted at the bottom. The layout of the discs and the fact that there are a precise number of discs ensures that the child will discover and correct an error in his layout should one occur.

7. Golden Bead Decimal System

The teacher introduces the Golden Beads by laying them out on a rug. When a child works on the floor a rug is used to focus the child's attention on the work and to provide a sense of order.

The golden beads provide 9 single unit beads, nine 10 bead bars, 9 hundred bead squares and one thousand bead cube.

Once the teacher has demonstrated the layout, the child is free to choose the work whenever he wishes. A Montessori classroom environment is designed so that the children are in charge of their own learning. The teacher observes the child and introduces a new material when the child appears ready. The golden beads provide an opportunity to feel how one compares to ten, one hundred and one thousand. They also begin the process of recognizing squaring and cubing a number. For example, a square can be made with ten tens and a cube can be constructed with ten hundreds.

8. Golden Beads and Number Cards

Number Cards are added to the golden beads to begin mathematical operations. The number cards are color coded with the units green, the tens blue, the hundreds red and the thousands green again.

The teacher represents a number with golden beads and the child goes to the number card layout and picks up the appropriate number card for each bead set. The child chooses one card at a time to focus on the particular order of number. In this case the teacher has chosen 3 units, 2 tens, 3 hundreds and 1 thousand. Once the child has brought back all the appropriate cards, the teach stacks them so that they all are aligned with the thousand card and then slides them down to reveal the answer. This action is called the magic slide

and gives the child the sense of wonder about the creation of a complex number. The cards have formed one thousand, three hundred and twenty three.

9. Golden Beads Addition

Here we see the layout for a Golden Bead Addition lesson. There are three trays, one for each of the addends and one for the sum. There is a "store" of beads for the students to draw upon. The store is normally kept on the shelf during this presentation. There are large and small number cards with the small cards being used for the addends and the large cards for the sum. Unlike most other materials, golden bead addition is only done with the teacher involved. Usually two students participate, each taking responsibility for a tray of beads representing an addend.

The teacher lays out cards for the student to match with golden beads from the store. Here the first student has brought back 2 units, four tens, 3 hundreds and 1 thousand. The second student brings back 9 units, 7 tens, 5 hundreds and 2 thousands.

The teacher demonstrates the magic slide to transform the number cards into numerical form. Let's listen as the teacher describes how she completes the presentation.

10. Golden Bead Subtraction

In this case three children participate in golden bead subtraction. The teacher has a very large number which each of the students will subtract their number from. The teacher's tray contains 9,999 beads and the corresponding number represented in large number cards. The teacher asks the first student how may units he needs. He needs three units, so she gives him 3 units. "How many tens" she asks? "I need three tens" the child responds continuing until the child has enough golden beads to match his number cards. The child is asked to verify that the correct number of beads have been provided. Finally the teacher does the magic slide to reveal the child's number.

The teacher then counts the remaining golden beads on her tray and lays them out to show that after the student's number has been subtracted from 9,999 the remainder is 8,566.

The teacher turns over the original cards to indicate that number is no longer relevant and proceeds to the next student, repeating the process.

11. Golden Bead Division

With Golden Bead Division, the teacher again has laid out the work for three students to participate. The number 3,693 will be divided by 3. She has chosen the number so that there will be no remainder as a beginning lesson.

Starting with the thousands, the teacher divides them between the students. One thousand per student. Moving on to the *hundreds,* she divides the hundreds*,* resulting in two hundreds per student. Each student receives three tens and one unit.

The children obtain number cards to match their golden beads and the teacher performs a magic slide to reveal that all three have the same number. Finally, she lays out the original number on the rug and says 3,693 divided by three people is 1,231.

The teacher concludes, "When you take a large number and divide it, you get a smaller number.

12. Stamp Game

In the Stamp Game, the student is given a problem by the teacher. In this case we are doing an addition problem. The color coded stamps are laid out to represent each number to be added. Like the number cards, the units are green, the tens are blue, the hundreds are red and the thousands are green representing units of thousands. The child lays out the stamps to represent the two addends. In this case he has 1,426 + 2,313. In this problem no carrying is required, but the stamps can be traded in for the next larger stamp, if necessary.

The beads are combined and the child records her number. Once the student is comfortable with the Stamp Game she can generate her own problems to solve.

13. Dot Game

The Dot Game gives the child the opportunity to add many numbers at a time. In this case we have six numbers, all over 1,000 to add. Starting with the first number the child places dots in each category one number at a time. The first number is 3,142 so the child places two dots in the units section, four dots in the tens section, 1 dot in the hundreds section and 3 dots in the thousands section. The process is repeated with the remaining five addends.

Once each number is represented by dots, we are ready to add. We notice that we have a complete row of 10 dots so we cross out the row and place a dot at the bottom of the sheet to represent one ten to carry over to the next sheet. We have two complete rows with no dots remaining so the units column gets a zero placed at the bottom. Next we write a two below the tens column and add two dots from the bottom of the units column and proceed with each column in the same manner until we have the solution: 15,620.

14. Teen Board

The Teen Board consists of number cards and beads. The child will use up to 9 ten bars and a new set of bead bars with 1 to 9 beads for the units place. These beads are color coded. The child begins with the tens in place and inserts a 1 in the first slot to form the number 11. He then places a ten bead chain and a unit bead to represent 11. This continues until the child reaches 19. The number 19 is formed with a ten bar and a 9 bar.

15. Ten Board

Using the Ten Board, the child has the ability to form any number from 10 to 99. In this case the teacher is demonstrating 58. 5 ten bars and eight unit beads represent the number. The 8 is removed from the ten board and replaced with a 9 to form 59. The child then adds a unit bead to match the number he has created.

Add one more unit and the child must trade in the 10 units for another ten, creating 60 and so on.

16. 100 Board

The Hundred Board .provides a 10 x 10 square grid for counting practice. The child places the appropriate tile in each square, reinforcing the concept of 9 as the greatest number of units and then changing to 1 ten greater, until all hundred squares are filled.

17. 4 Square Chain – Linear Counting

Every 3-6 classroom has a bead *cabinet* with chains of beads representing the *squares and Cubes* of numbers 1-10. Here the teacher demonstrates the four chain. She has counted each segment, labeling the beads with numbers. The 4 chain can be folded to form the *square of 4,* or 16. The 4 square beads serve as a control of error for the student.

18. 4 Cube Chain

The Four Cube Chain is laid out by the student. Each segment is counted and labeled as you see here. The 4 cube chain can be folded *to* form 4 squares which stack to form the cube of 4 or 64. Again, the four square beads and the 4 cube beads provide the student with a control of error. These exercises build a visual and tactile sense of the meaning of numbers and the function of squaring and cubing.

19. Addition Snake Game

Color-coded bead bars representing each number from 1-10 are used for the addition snake game. The child can choose any combination of numbers to add. In this case she has chosen 6+3+4+2+1. Consistent color coding gives the child an additional clue in identifying the number of beads on each chain. Let's watch as the teacher demonstrates this material.

20. Addition Finger Chart

The Addition Chart includes a container with all the addition problems from 1+1 to 10+10. The child draws an equation from the container and lays it on the platform provided. Next, he copies the number on a small sheet of paper. Using her fingers, the child places a finger on each number on the red and blue rows to represent the addends. Sliding the fingers together along the matrix, the child discovers the answer. Repetition of this activity leads to memorization of the addition table.

Upon completion of the problems the child can check her answers with a control chart. The use of a control chart enables the child to be totally independent in doing this work.

21. Negative Snake Game

In the Negative Snake Game, bead bars are laid out to represent positive and negative numbers. The negative numbers are all color-coded gray. The child counts the beads until she reaches a total of ten and exchanges the beads for a ten bar. If a few beads are left over, those beads are replaced by the appropriate number bar and the counting continues. If a gray bar is encountered, it is placed parallel along the accumulated beads and the same counting process is done except these beads are removed from the chain. This process continues until a positive or negative number of beads remains. When the process is complete the remaining beads are laid out to represent the answer.

22. Subtraction Strip Board

In the Subtraction Strip Board a matrix of squares 19 across are used to practice subtraction tables. The child chooses a table. In this case the table of 14 is chosen. The brown wooden bar is used to block the numbers from 15-19 that will not be used. The blue bars represent the numbers 1 – 9. The child places each bar on the board to reveal the answer to the equation. Placing the 9 bar on the Board creates the equation 14-9 equals 5. 14-8 equals 6. She continues until the table of 14 is completed.

23. Multiplication Board

The Multiplication Board is used to memorize the multiplication tables. The table to be practiced is represented by a number placed in a slot in the board. In this case we are going to practice the table of 6. 6 beads are laid out in column one to represent 6X1. The answer 6 is placed on the table. The 6x2 equation is represented by moving the red disc to the second column. Six beads are added and then all the beads are counted. 6x2 is 12. The process continues until the table of 6 is completed. The child can choose to move on to another multiplication table or choose another type of work in the classroom.


24. Multiplication Finger Chart

The Multiplication Finger Chart works in the same way as the addition finger chart. The child can choose an equation from the container. By sliding her fingers from the red and blue columns, she can discover the answer to the equation. Repetition of this work and the multiplication board will result in the memorization of the multiplication tables.

25. Unit Division Board

The Unit Division Board is used to practice division problems. In this case the teacher is going to divide the number 14 by 9. The divisor is represented at the top of the board by 9 green skittles. The dividend is represented by 14 beads. counted out into a cup and then distributed 1 to each skittle across the board. Each bead is laid out in a row to match the skittles. After a row is complete another is started until the beads are exhausted. Each row is counted. There is one row, with five beads remaining. The answer is 1 with a remainder of five.

26. Division Finger Chart

The Division Finger Chart enables the child to practice her division tables. A problem is chosen and laid on the platform. In this case, the equation is 45/9. Sliding the fingers on the chart reveals the answer 5.

27. Small Bead Frame Addition

The Small Bead Frame provides an abacus like tool for doing math. Here the teacher has chosen to add 3,421 and 5,324. She writes out the equation and begins adding the beads starting with the units. If the category exceeds 10, a bead in the next row is moved and the entire unit row is moved back to the left side and the counting continues until the units are all counted. Then she moves on with the tens, hundreds and thousands to find the answer to the equation. Once the Small Bead Frame is mastered, the child can move on to the Large Bead Frame, with categories up to the millions.

28. Metal Inset - Fractions

The Metal Inset Fractions allow the child to visually discover how various fractions compare to each other. In this case we look at the fraction of 1/2. Do 2 thirds add up to one half? No. Do 2 fourths add up to one half? Yes. Do three fifths add up to one half? No. How about 3 sixths? Yes. This process can be continued with all the metal inset fractions to compare a variety of fractional relationships.