

DAY 13 - 17

UNIT 4

MATHEMATICAL APPARATUS & ACTIVITIES

Pre Home Assignments

Learning Activity 1: Read passage & Meditate: Should read the passage in this unit minimum 3 times. After reading each paragraph, close your eyes & think about the paragraph content for a few minutes. Also do the preparations for the Live Class Lesson Activities.

Learning Activities for Live Class Session:

Learning Activity 1: Face to face Interview: Two pupils sit face to face like a TV interview. One acts as Dr. Montessori. The other one asks questions about Mathematical Apparatus and its benefits. After one round, change the pair & continue practice.

Learning Activity 2: Guided Imaginary Activity practice with closed eyes: Sub: Exercises of Mathematical Apparatus in a Montessori House of Children.

Learning Activity 3: Reality Show of Mathematical Apparatus: Conduct a Reality show like in TV. Each student becomes a Mathematical Apparatus and presents its way of practice, direct benefits and other benefits from the practice in front of the judges.

First round: Signing in and brief self-introduction round.

Second Round: Presents its way of practice, direct benefits and other benefits.

Third Round: Argument & Verbal debate in between each Mathematical Apparatus.

Faculty become Judges and tell the judgement and marks. One student acts as the anchor.

Learning Activity 4: Pair Reverse Quiz game related to Mathematical Apparatus: One student keeps a Mathematical Apparatus name in mind and the other student makes a guess by asking questions to her. Then change roles and continue the game.

Learning Activity 5: Speech: Write each Mathematical Apparatus name in a small piece of paper. Fold or roll and keep them together. Let a trainee pick one from the lot as lotto pick and give a speech about the same for 3-4 minutes.

Once it's done, remove that from the lotto and continue the process with remaining trainees. Giving opportunities to all students. One student anchoring the Program. If students are more, make more numbers for each mathematical apparatus.

Learning Activity 6: Quiz competition related to all Apparatus: One student becomes Quiz Master and prepares questions related to all Montessori Apparatus. At the end of the competition, Quiz Master declares the winners. Give chances to other students also to conduct Quiz competitions based on the time availability.

Learning Activity 7: Group Discussion: Arrange a Group Discussion like in TV. All students are participating in the discussion.

Round 1: Purpose and objectives of learning and practising the content in this unit

Round 2: How to apply the knowledge and the ideas in this unit in your life, career and in society.

Learning Activity 8: Sharing Ideas: Each student shares ideas about other Mathematical activities possible to practice in a Montessori / nursery school. One student coordinates / anchors the program and invites one by one to participate in the program. Collected ideas from others writing in your Theory Assignment Book.

Learning Activity 9: Face to face TV Interview: Two pupils sit face to face like a TV interview. One acts as Dr. Montessori. The other one asks questions about Mathematical Apparatus and its benefits. After one round, change the pair & continue practice.

Learning Activity 10: Screen Share Presentation: All the students are presenting the photos of their Montessori Practical Record Book page by page and giving a brief description about each Mathematical apparatus just like PowerPoint Presentation. One student acts as the anchor. Faculty judges each student's presentation and declares the winners.

Learning Activity 11: Learning activity as per students' choice. Conduct a learning activity as per the choice of lesson activities coordinating group.

Self-Home Assignments & with classmates:

Learning Activity 1: Self Speech in front of Mirror: Do a Self-Speech about each Mathematical Apparatus for 4-5 minutes. Speech Topics:

1. Large Number Rods

2. Cards & Counters
3. Sandpaper Numerals
4. Spindle box
5. Seguin board
6. Small Number Rods
7. Beads Frame Big & Small
8. Beads Stair & Pyramid
9. Beads and Decimal System
10. Fraction Insets
11. Addition, Subtraction, Multiplication & Division Strip Boards

Learning Activity 2: Face to face Interview: Two pupils sit face to face like a TV interview. One acts as Dr. Maria Montessori. The other one asks questions to her regarding Mathematical Apparatus and its practice in a Montessori House of Children. Faculty prepare the list & put it in the group.

Learning Activity 3: Pair TV Interview with a Montessori Directress: One takes the role of a Montessori Directress and the other one takes the role of an anchor. Sub: Use and practice of Mathematical Apparatus written below:

1. Large Number Rods
2. Cards & Counters
3. Sandpaper Numerals
4. Spindle box
5. Seguin board
6. Small Number Rods
7. Beads Frame Big & Small
8. Beads Stair & Pyramid
9. Beads and Decimal System
10. Fraction Insets
11. Addition, Subtraction, Multiplication & Division Strip Boards

Learning Activity 4: A parent's Interview with a Montessori

Directress: One takes the role of a Montessori Directress and the other one takes the role of a guardian of a Montessori school student.

Sub: Use and practice of Mathematical Apparatus written below:

1. Large Number Rods
2. Cards & Counters
3. Sandpaper Numerals
4. Spindle box
5. Seguin board
6. Small Number Rods
7. Beads Frame Big & Small
8. Beads Stair & Pyramid
9. Beads and Decimal System
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11. Addition, Subtraction, Multiplication & Division Strip Boards

Learning Activity 5: Self Speech in front of Mirror: Do a Self-Speech about other useful Mathematical activities in a Montessori school.

Learning Activity 6: Pair TV Interview: Two pupils sit face to face like a TV interview. One acts as Dr. Montessori. The other one asks questions about Mathematical Apparatus and its benefits. Faculty prepare the list & put it in the group.

Individual & pair learning activities as Post Home Assignments:

Learning Activity 1: Write Biography in Cursive Handwriting :

Write the biography of Dr. Maria Montessori in a Cursive way in 10 A5 pages (5 A4 pages).

Learning Activity 2: Mathematical Exercise: Practice the possible Mathematical activities with the mind of a kid. If you have kids in your house you can practice with them too.

Learning Activity 3: Illustrated Montessori Apparatus Record Book (House Assignment: for this entire practical session): For this unit: Make a session about Mathematical Apparatus by including each Mathematical Apparatus name & photos with a short description about its way of practice, direct benefits, other benefits etc.

Learning Activity 4: Tell a brief idea in English about Montessori Mathematical Apparatus and its benefits to your English fluent external friend.

Learning Activity 5: List of Other Mathematical Activities: Make a list of other useful Mathematical activities for KG children from your experience and thought and write those in your Apparatus Record Book.

Learning Activity 6: Watch good videos: Watch good videos related to Mathematical Apparatus activities from good Montessori Schools (Eg: Europe) on YouTube or other internet media.

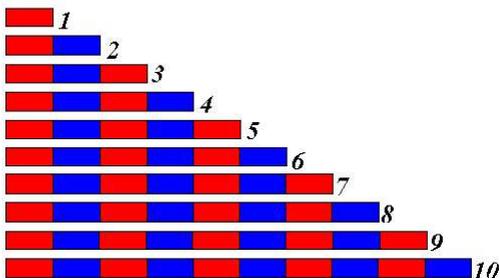
MATHEMATICAL APPARATUS: PRACTICE & BENEFITS

1. Large Number Rods

A set of Number Rods consists of ten colored rods, divided into equally-sized red and blue sections. The length of the rods progresses linearly, with the second rod being twice the length of the first, the third rod three times the length of the first, etc.

Practice and direct benefits:

The Number Rods also help children learn the names of numbers and their sequence and learn to correctly associate between the spoken number and its quantity. Children grow to understand that each rod represents a unique quantity and that each number is represented by a single object as a whole, separate from others.



Later on, students work with another material, the Number Rods and Cards, which link the symbol for a number to the physical quantity.

Other benefits:

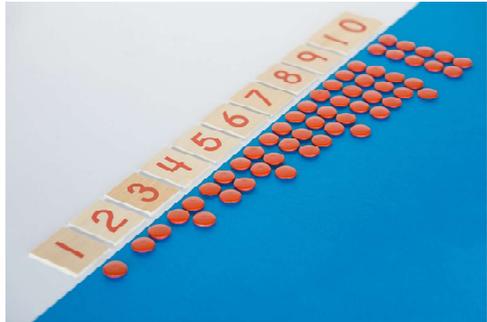
Number Rods can be used in several different ways, depending on the individual student's level of mastery. The student can name the rods by their length and count the colored sections, or, given the name of a specific rod, a student can select that rod out of a group. A student can identify the rods in sequence or from a randomised order. The first type of exercise reinforces the sequence of the numbers, while the second kind strengthens a child's judgement of individual quantities. These exercises can also be done from a distance, so the child can practice retaining information in his memory. For



example, a Guide might ask the student to walk across the classroom to retrieve a certain rod.

2. Cards & Counters

Cards and Counters is a material that consists of 10 number cards, 1-10, and 55 round, red counters, each approximately the size of a nickel. This work is typically organised on a floor mat in the Montessori classroom, as it requires a bit of space.



Practice and direct benefits:

To reinforce the knowledge that each number is made up of separate quantities.

To verify whether the child has mastered:

- his sequence of numbers
- How many separate units go to form each number

To indicate the odd and even numbers



Other benefits:

To prepare for the divisibility of numbers

3. Sandpaper Numerals

Sandpaper numbers are the mathematically-focused friend of the sandpaper letters. Just as the letters prepare children to write the alphabet, the sandpaper numbers introduce the child to the names and shapes of the symbols that represent quantities. Fine-grain sandpaper cutouts of the numbers from 0 to 9 are each mounted on their own green wooden board. The distinct feel of the sandpaper and its contrast with the smooth board helps guide the student's fingertips while they trace the symbols.



Practice and direct benefits:

The direct purpose of the Sandpaper Numbers is to teach children the symbols that represent each number, allowing them to visually identify any number from 0 – 9. In Montessori education this is specifically taught separately to counting from 0 – 9, where children often fall back on rote memorisation.

Due to the tactile feel of the number cards, the material also prepares children for the writing of numerals, which can be used as an extension activity for the Sandpaper Numbers.

Children are introduced to the Sandpaper Numbers from three years of age. Work with this material is often followed by the Number Rods, which also introduces numbers 1 – 10, and the Spindle Box, which introduces the concept of zero.

Other benefits:

The student engages several senses as he uses his eyes, ears, and hands to experience each number. This multi-sensory physical engagement helps build strong memories of the symbols that will come in handy when learning to write them on paper! After mastering the Sandpaper Numbers, a child can start learning to link a number's symbol to the physical quantities it represents.

4. Spindle box



Two identical boxes. 5 compartments in each box. The numbers are written on the back of the compartment (0-9) which contains 45 spindles.

Practice and direct benefits:

Spindles are placed in the compartment based on each number.

Understands the concept of '0' but 'none'.

Understand the serial number.

Other benefits:

Understand that the numbers 0-9 are used to write any small or large number.

Drift development of fingers.



5. Seguin board

Two wooden boards with number cards from 0 to 9. These cards are removable and replaceable.



Practice and direct benefits:

Numbers 11 to 99 for in-depth familiarity.

To understand the numerical sense above ten.

Understands number name, order and symbol correctly.

Other benefits:

Numeracy

Recognizes position value.



6. Small Number Rods

Two sets of ten number rods. The smallest is red. Then alternately red and blue.

Practice and direct benefits:

Each number counts based on the colour of the rod.

Sorts by small and large, and vice versa.

Identifies the dimensions of each number.

Other benefits:

Identifies small / large.

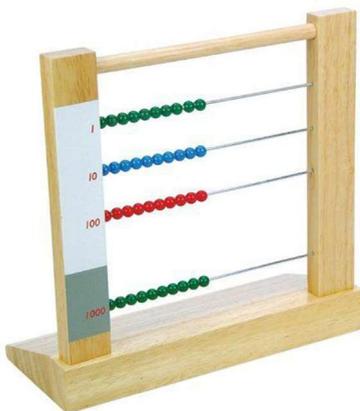
To remember the number order.

Mathematical brain development.



7. Beads Frame Big & Small

Frame with stand to stand freely. The small frame has four wires and the large frame has 7 wires horizontally. Ten pearls on each wire. The position value of each wire is given on the left side of the frame.



Practice and direct benefits:

The pearls on each wire are counted according to their position.

The pearls are arranged according to the position of the numbers in a number.
Adding and subtracting small numbers.



Other benefits:

Recognizes position value.
Writes and reads large numbers.



8. Beads Stair & Pyramid

Each bar has beads from 0-9. Each bar is in a different colour.

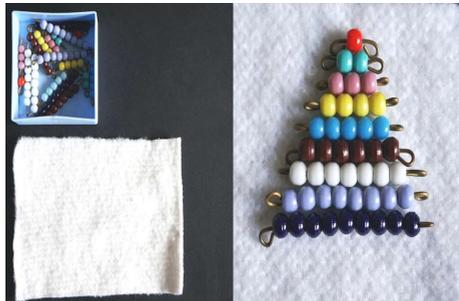
Practice and direct benefits:

Beads arrange the bars in ascending and descending order.

Understands the magnitude of the number from 0-9.

Other benefits:

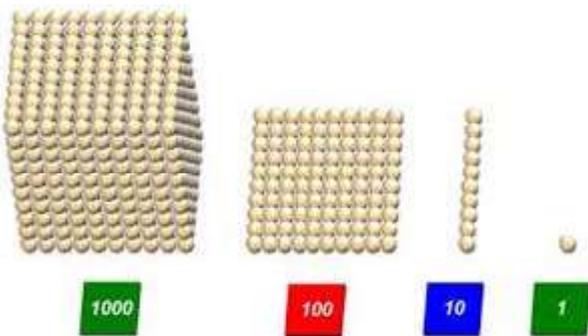
Creativity
Concentration



Co-operation between eyes and hands.

9. Beads and Decimal System

A small tray with 1 bead, 1 bar of 10 beads, 1 square of 100 composed of 10 bars of 10 and a cube of 1,000 composed of 10 squares of 100.



A large tray with a supply of beads from each category

Practice and direct benefits:

Geometrical entities are used by Montessori as Material Abstractions for the decimal system of numeration



1 Golden Bead is a unit (point)
10 Golden Beads make a 'bar of ten'

10 'bars of ten' make a 'hundred square'

10 'hundred squares' make a 'thousand cube'

To introduce the child to the concept of the decimal system.



To make the child familiar with the names and relative sizes of the categories

To help the child with the difference in bulk between e.g. 6 units and 6 thousands.

Other benefits:

To experience the ordering effect of the laws of the decimal system
To become familiar with the mechanism for changing from one hierarchy to the next.

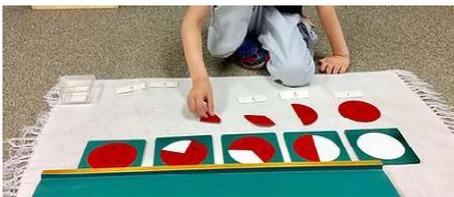
10. Fraction Insets

Materials: - Red fraction circles in green frames: ten circles – 1 undivided and the others divided into 2 to 10 equal parts.

- Label with fractions written on them: 1, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{3}$
- Pencil and paper
- Skittles

Practice and direct benefits:

By working with the insets, the children learn that there are quantities less than one but higher than zero, and they are able to begin comparing these quantities by removing pieces from one inset and comparing them to another. Imagine being able to replace two $\frac{1}{4}$ pieces of a puzzle to discover that you can fill the space remaining with both a single $\frac{1}{2}$ piece or four $\frac{1}{8}$ pieces. Children can interchange pieces between the frames as they discover how each sliver helps to create a whole.



Other benefits:

Eventually, children will also be introduced to the written symbols for each fraction and will be able to begin mathematical operations with fractions, adding, multiplying, dividing and subtracting fractions independently and with materials that are self-correcting and beautiful. As a result, children explore maths concepts in a more authentic way, internalising complicated ideas from maths earlier than they may even be exposed to them in traditional classrooms and with a deeper understanding of what the curious symbols of maths really mean. Look for the advanced fraction materials in our Kindergarten and First Grade experiences.

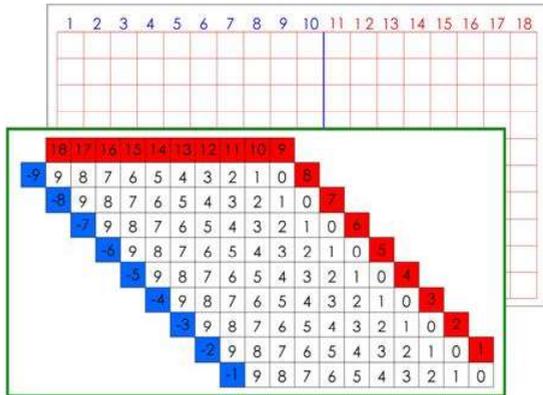
11. Addition, Subtraction, Multiplication & Division Strip Boards

- A board divided into squares (each 2cm x 2cm) across from left to right and 11 squares from top to bottom. The topmost squares are numbered 1 to 18; from 1 to 9 are in blue and from 10 to 18 are in red. There is a blue line that divides the board vertically after the number 9. There is a red line that divides the board horizontally after the number 9.

0	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

- 2 sets of strips, one set is blue with symbols 1 to 9. The other set is red, which is subdivided into squares by blue lines. The end square of each strip is marked with the symbol that corresponds to the number of its squares.

-A set of plain wooden strips (not colored or numbered) progressing in length from the first and smallest strip (2cm x 2cm) by adding one square to its length with each succession strip so that the last strip is 17 square long.

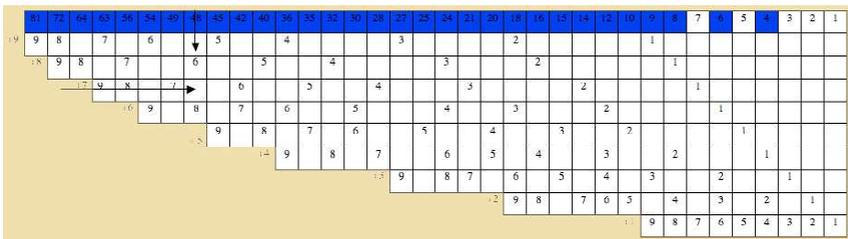


Practice and direct benefits:

To give practice in addition, subtraction, multiplication and division leading to the memorization of the essential facts.

Multiplication table

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144





Arithmetic Activities for 4 year old children:

1. Order your child to obey: Clap your hands seven times, jump five times like a dog, touch the T.V. three times, go and bring two stones, 6 flowers, one banana etc.
2. The child may be given different vessels and some mangoes or potatoes. He can put them in each vessel, experiment and find out how many each vessel would contain.
3. When you go shopping, let your child pay the bill and collect the balance amount.
4. As you and the child eat oranges, apples or mangoes, the child may count the fruits as well as the seeds inside.
5. Ask these questions to the child: Which number comes before three? Which number comes after nine?
6. Ask the child to count & tell you the total number of chairs in the house.
7. Dictate some of the one digit numbers and let the child write them.
8. You can draw common geometrical shapes: square, circle, triangle etc. Ask your child to fill it with lines or dots.
9. You can draw a figure, for example: an oval or a circle. Let the child draw many smaller figures inside your figure.
10. Let the child learn to thread a needle and stitch an old greeting card. (First you should draw a figure and put holes on it, to make

stitching easy for the child.)

Other Arithmetic Activities for children:

1. Let your child write as you dictate a large number, for example: 7856
 2. Ask the child to show you the units, tens, hundreds and thousands in the above number.
 3. Occasionally ask the child to tell you the time, looking at the wall clock.
 4. Let the child look in the calendar on the wall, and tell you the total number of days in the twelve months.
 5. Ask your child to dial the phone number when you want to call somebody.
 6. A meaningful way to make the child know about days, weeks, months and a year: you can ask the child to cross out the days, weeks and months as they pass by.
 7. Help the child to guess the age of people. Looking at the photos in magazines and newspapers, the child is guided to judge the age of the persons in the pictures. He can also guess the age of friends and relatives coming home now and then.
 8. The child can measure the length, width and height of tables, chairs, beds etc. with a tape. Let him draw the figures on a paper and write the measurement in centimetres.
 9. Ask the child to guess the length, width and height of the bridge, cupboard, shelf etc.
 11. Put a lot of coins in a box. There should be a good many 25 paise, 50 paise, 1 rupee, 2 rupee and 5 rupee coins. Tell the child to give you a rupee using 25 paise coins, 50 paise coins. Ask him to give your Rs 10 and Rs 25 in different coins.
 12. Ask your child to draw different geometrical figures: circle, square, rectangle, triangle, oval, ellipse, pentagon, octagon etc. Let the child write the number of sides of each figure.
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