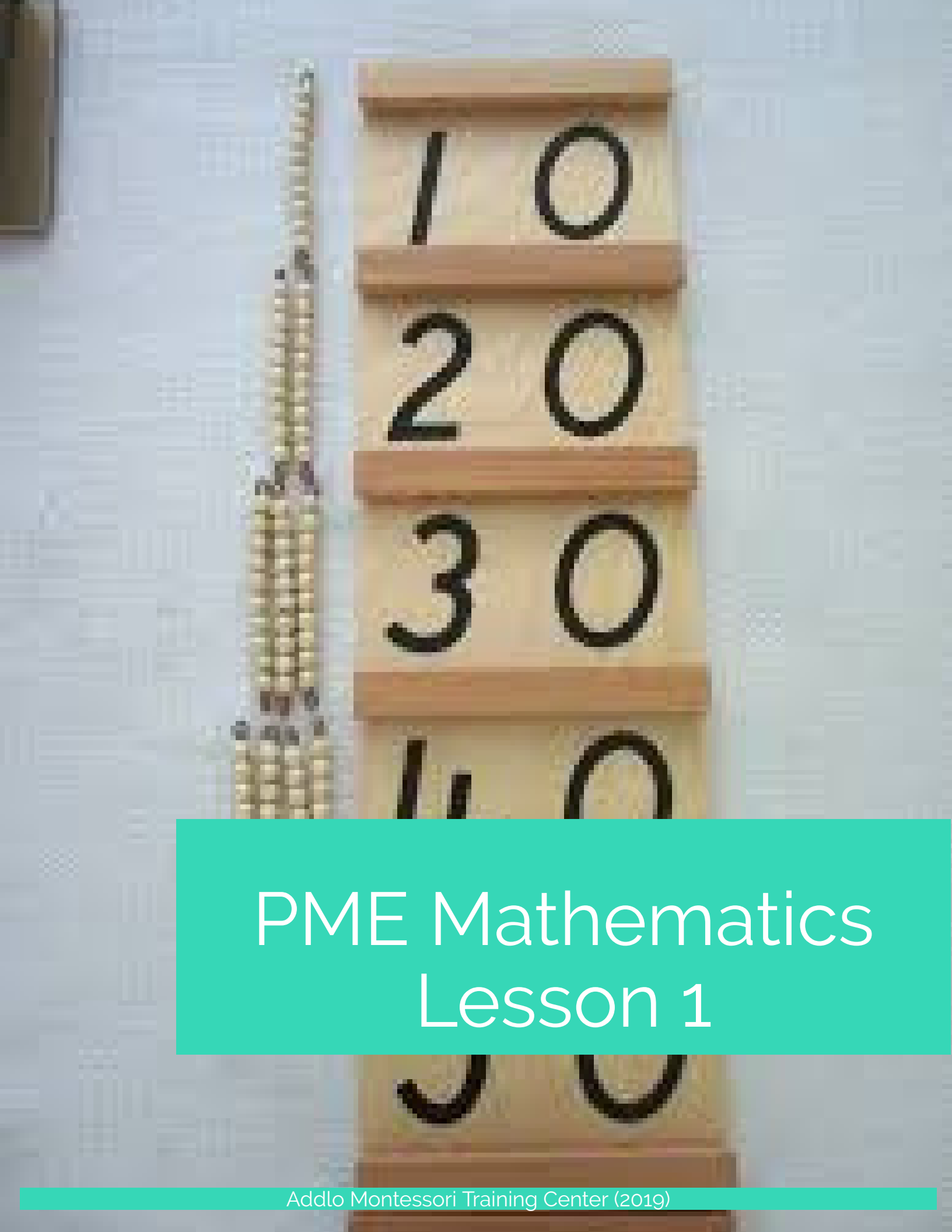


PME Mathematics Lesson 1

This week we shall begin the study of Mathematics in the Montessori 3 to 6 years setting.

Mathematics

Lesson Objectives:

1. Have a full overview of the Mathematics Curriculum and understand its core differences from the traditional method of teaching Mathematics
2. To give a full scope and the sequence of the lessons.
3. To study the core lessons that introduces the numbers 1 to 10

INTRODUCTION

Mathematics is one of the subjects a vast majority of people worldwide don't like. Children in general find it difficult to understand mathematical concepts. The reason for this in the traditional school setting is that mathematical work is done in the abstract without first giving the child a chance to understand maths in concrete terms.

So many children feel uncomfortable about mathematics because they see it as a boring subject with its abstract symbols that they do not understand. It is usually assumed that children learn by internalizing knowledge; teachers simply correct the errors and present the right answer. Many teachers know that this is not true yet they keep on correcting the same error day in day out. The truth is children need to see how numbers change and grow and relate to each other. They need to build up a concrete model of mathematics mentally before they start next step, which is working in the abstract. On the other hand, even the wrong answer could be productive because any wrong answer could provide more in-depth thinking if children can try to work it out in areas where it didn't work and to figure out why is doesn't work. But all this takes time.

The Montessori Mathematics curriculum takes this on board and helps the child understand Mathematics from the concrete to the abstract in little comfortable steps that brings the subject alive and interesting for the child.

Mathematics is very important in our daily life because we can see that numbers are everywhere. From The Absorbent Mind, Dr. Montessori wrote,

" Children at an early age are urged by the laws of their nature to find active experiences in the world about them. For this they use their hands, and not only for practical purposes, but also for acquiring knowledge."

In the Montessori setting we use the hands as a very important tool to learn mathematical concepts. The hands and the Montessori materials are crucial. Always think practical application, activity based and hands-on instruction.

An Overview of the Montessori Maths Curriculum for 3-6 years.

In the Montessori classroom, math is presented in a fun and interesting way by using concrete materials during the school year, and this helps children develop concrete to abstract concept. Also, children have free choice of what to work on according to their own inner needs.

In "The Secret of Childhood", Dr. Montessori stated,

"The principle of free choice was thus added to that of repetition of the exercise. The free choice made by the children enabled us to observe their psychic needs and tendencies".

Repetition is necessary for the child to refine his senses, perfect his skills and build up his competency and knowledge. Through free choice and repetition, children can acquire their knowledge step by step depending on their own needs, not on the teacher or parents. So, there is no pressure or hurry to build their knowledge by themselves.

It is always useful to prepare the child for Mathematics, just as you do for reading and writing.

This may have been done at home or at the playgroup sessions the child may have attended. It is suggested that to make sure that the children are ready and that the concepts introduced to them make sense a bit of time should be spent preparing them or reminding them of the different readiness concepts for their mathematics journey.

The first mathematic materials for the Montessori 3-6 classroom include: Numeral Rods, Sandpaper Letters, Printed Numerals, Spindle Box, Cards and Counters, and the Coloured Bead Bars. By manipulation of these materials, children build up a basic concept of numbers one to ten not only to memorize the natural order of numbers, but also to recognize the difference in quantity of each number.

After mastering the basic concepts, children need to understand the place value in math. The Decimal System introduces children to the place value to thousand. Through working with the 9-Tray, the 45 Layout and the Formation of Complex Numbers, Seguin Board A (Teen Boards), and Seguin Board B (Ten Boards), children will develop mathematics concept beyond ten. When children recognize the written symbols and know their meaning, they then need to perform the exercises in remembering numbers.

In "The Discovery of the Child", Dr. Montessori said that

"A child must therefore remember his number not only while he moves among his companions as he approaches the large table, but also while he is picking up his pieces and counting them one by one."

This skill is facilitated through the use of the following materials: Sequence Board, Addition Board, Subtraction Board, Multiplication Board and Division Board. The Bank Game will help children learn and consolidate the concept of addition, subtraction, multiplication and division. Children will acquire mathematical operational principle in concrete way because they may have previous experience of going to the bank with their parents.

After understanding Dr. Montessori's mathematics materials, we can figure out that she did not present mathematics as a terrible or boring subject, but she used the concrete materials to allow the children build a step-by-step knowledge of numbers and shapes. The teacher plays an important role in a Montessori's classroom; they need to understand that children will reveal themselves through work. The teacher must observe and help the child achieve the aim of the material they are working with and move them to the next level.

The Montessori method may seem slow to a lot of traditional method tutors, but if the aim is to engage children in learning basic mathematical concepts and manipulations which can help them succeed in the world as adults then the Montessori Mathematics curriculum for ages 3-6 would be the very best way to start the children on the road to understanding numbers and how they work.

Maths Readiness

Everyday experiences should give the child simple number ideas. It is important thought to note that knowing how to count from 1 to 5 or 10 is one thing and using the skill mathematically is quite another thing. It is important to discover how real this knowledge is , clarify , consolidate and gradually extend it.

Use the following activities for illustrating, discussing and reinforcing simple number vocabulary.

Number Songs, Rhymes and Stories. E.g.

Ten little Monkeys jumping on the bed

One fell down and bumped his head

Mama calls the doctor, the doctor says,

“No more monkeys jumping on the bed”

- Dancing to Rhythms. Children can beat on the drum, others clap their hands and dance and you keep time by calling out “one, two, three, four, one, two, three, four”
- Counting arms, legs, ears etc. “How many eyes has she?, How many legs do you have?”

The Scope and Sequence of Montessori Mathematics 3 to 6 years

Number Rods and Cards

Cards and Counters

Large Number Cards

Short Bead Stair

Introduction of Units and Tens

The Spindle Boxes

The Zero Game

Seguin Board A

Seguin Board B

Sets of Cards

The Snake Game

Addition with Small Number Rods

Addition with Short Bead Stairs

Subtraction with Short Bead Stairs

Addition Strip Board

Subtraction Strip Board

The Golden Bead Material

Teaching the Names of Quantities

Counting through 1 to 1000

Bead Practice

Naming the Cards

Cards in Sequence

Card Practice

Combining Quantity and Symbols

Bird's Eye View

Addition without Changing

Addition with Changing

Subtraction without Changing

Subtraction with Changing

Introduction to Multiplication without Changing

Division

Multiplication Board

Division Board

Fractions

Learning to count and recognize numerals 1 to 10 the Montessori way:

NUMBER RODS

Description of material:

This is a graduated set of ten wooden rods, each measuring from I decimeter to 1 meter in length. The first decimeter and every alternate decimeter on every rod are red while the intervening decimeters are blue.

Aim:

To learn the number names I to 10

To associate the number names with their quantities

Presentation A:

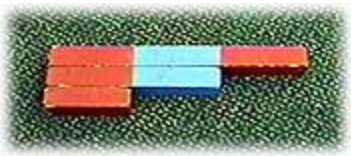
Do a three period lesson of the first three rods naming the rods, using the first period.

Put the number one rod in front of the child being careful not to hide the rod with your hand, slide over the rod with your finger and say " One…This is one"

Put the rod to one side and pick up the number two rod and place it in front of the child, slide your fingers over the rod and say, "Two…This is two"

Put the rod with the number one rod and pick up number Three rod and do the same as above with it.

Next day revise, using the second period, do this by putting the three rods in front of the child in mixed order. Each rod is parallel to the others and the rods are a short distance apart then ask the child to show you or give you a number rod, say "Give me Two" or "Show me Three" If the child is successful then it means he has made the association between the name of the numerals and quantity. Now introduce the concept of counting by touching each rod and saying " One, Two, Three" Arrange the rods in sequence with the red ends even on the left and count the rods, "One…Two…Three."



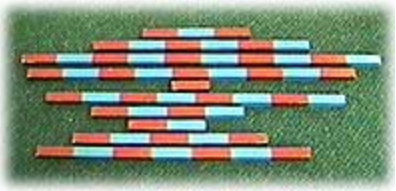
Next day revise this using the third period, ask the child, "What is this?" pointing to one of the rods. If at any point the child cannot remember the number name simply go back to the first period and continue to work on this until the child is comfortable and knows the numeral names.

Continue with the exercise adding on to the rods until all the rods have been introduced and numeral names learnt.

Presentation B:

Place the rods randomly on the mat

Then arrange them with the red ends on the left lined up evenly same as for the red rods.



Let the child have a go at doing this if he wants to.

This exercise will give the child the opportunity to handle the rods and compare their lengths. The child may show the use of intelligence when he realizes on his own that the rods are the same length as the red rods and then put them together to compare them.

Do not mention this similarity in lengths to the child, it must come from the child.

Control of Error

The rods form a stair. The left hand side all in reds and on the right side the rods end alternately in red and blues.

Age: 3 years.

THE SAND PAPER NUMERAL CARDS

Description of Material:

- Ten Numeral Cards with the symbols 1 to 10 cut out of fine sand paper and mounted separately on each card.
- A tray for carrying material
- A mat or Workspace

Objectives:

- To teach the symbols of numbers 1 to 10.
- To enable the child to associate the written symbols with the spoken names.
- To teach the child how to form the written symbols through tracing with his fingers. This gives the child a muscular impression of the symbol.

Presentation:

- Tell the child you have something to show them
- Take child to the place of material on shelf and show how to carry material and place on workstation
- Take out 1, trace three times with dominant fingers and say its name: “one”
- Give to the child to repeat, place the board at the top of the table.
- Repeat for numbers 2 and 3.

Do a Three Period Lesson with numbers 1,2, and 3.

Period 1

Sit beside the child with numerals to one side. Place the numeral "1" card in front of child, hold it steady with hand and trace lightly with index and middle fingers of dominant hand. Trace the numeral as it is written and repeat its name, "One…This is one…This is the way we write one."

Place the numeral card in front of the child and invite to feel the numeral, while child is doing this continue to repeat the name. The child may spontaneously repeat the name after you but do not ask child to do this.

Place numeral card to one side and take the "2' card, place in front of child and trace lightly repeating the name as done for the "1" card. Invite child to feel many times and continue repeating the name of the card.

Place to one side and do same with the "3" card.

Period 2

Place both numerals in front of the child. To ensure that the child has made the association between the numeral and its name ask child, "Can you find 2 and feel it?" Repeat this for the other numbers and do several times. If child is not successful then simply return to Period 1 next time and follow through until child has achieved set objective of making the association between the the numeral name and its written symbol.

Period 3

Give the child a numeral and say, "Trace this and tell me its name." Repeat this with each numeral in turn. If unsuccessful simply return to period 2 and work with child until you are sure they have made the association.

This process may be done over a couple of days or in one lesson depending on child. There is no need to rush. The goal is to ensure that the objectives set are attained.

If successful then teacher should place the numerals 1-3 in sequence, point to each from left to right name and trace and say " We have now learnt how to write the numbers 1,2, and 3.

Repeat same for numbers 4,5, and 6 and then for numbers 7, 8, and 9. Introduce and teach new numerals as child is ready. Always include the numerals already learnt in the lesson

Depending on each child it may take a couple of days to teach.

Control of Error:

The sandpaper guides the child's fingertips.

Age: 4 years +, after Number Rods have been introduced.

THE NUMBER RODS AND CARDS

Description of Material:

- The Number Rods
- A set of numeral cards (black on white)
- A mat.

Aim:

- To relate the symbols to the quantities that the child knows
- To introduce the sequence of the symbols
- To prepare the child for addition, subtraction and multiplication

Presentation A:

Tell the child you have something to show them today

Tell the child to choose his workspace

Show the child where the number cards are kept and carry them to the workspace

Then ask him to bring the number rods

Mix the rods up

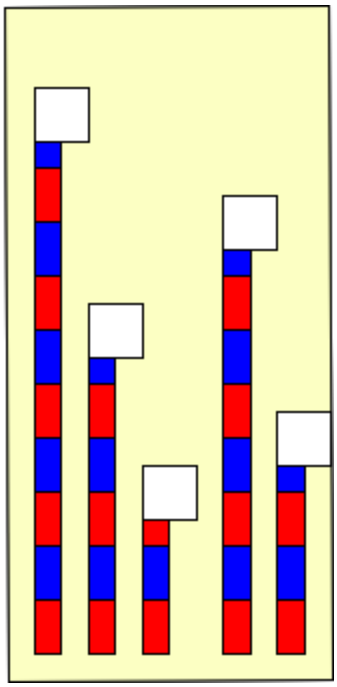
Place the numeral cards on the mat.

Show the child a rod and ask him to count it

Then ask for the corresponding numeral card.

Prop the numeral card against the last section of the rod.

Repeat this until each rod has the correct numeral card propped against it.



Another Exercise:

Show the child a numeral card and ask him to name it and then fetch the corresponding rod.

Place the card against the last section of the rod

The child can then work by himself counting and placing the correct card on the rod in sequence.

Presentation B:

Introducing the concept of addition

Making 10's

Set out the number rods in a stair formation mid-way down the mat.

Take out the cards and place them randomly onto the mat.

Separate the 10 rod from the others, moving it up to the top of the mat

Let the child count and place the appropriate card on the last section of the rod.

Move the 9 rod up a little below the 10 rod.

Ask the child what rod it is and place the correct card on it.

Tell the child, “I wonder what we could put to make this nine the same size as the ten”

Have the child place the 1 rod at the end of the 9 rod to make it the same length as the 10 rod. Then place the 1 card at the end of the 1 rod.

Point to the numbers and say “9 and 1 is 10”

Repeat this with the child

Do the same for the 8 rod and make it the same length as the 10 rod by adding the 2 rod to it.

Say, “ 8 and 2 is 10”

Repeat for the 7 rod and the 6 rod.

When you get to 5 rod, have him place the end of the far tip right side to line it up with the 10 rod and place the card on it.

Ask the child if we have anything in the classroom that is similar to the 5 rod.

Have the child bring over the fifth rod from the Red Rods and see if it is the same length as the 5 number rod.

Place it to the left of the 5 number rod and notice that it makes the same length as the 10 rod.

Replace the Red Rod back on the shelf and have the child rebuild the rods in stair formation

Replace the cards in the box.

Making 9’s, 8’s, 7’s, 6’s, 5’s, 4’s, 3’s, and 2’s.

Repeat as in Presentation B but this time start with the number Rod 9 and have the child make 9’s this time. (Remove the Rod 10 out of the way)

For making 8’s, remove 10 and 9 rods etc.

Presentation C:

Introduction to Subtraction

Making 10's

To be done on a day the child has made 10's or you have asked him to make 10's.

Show the child the first 10 (with the 5 rod)

Flip it over to the left side and say if we take 5 away, we have… 5.

Look at the 6 and 4 rods.

Ask, "Do we have another 10? … Yes!"

"If we have 10 and we take away 4 we have … 6."

Move the 4 rod down under the 5 rod and move the card.

Repeat for the others.

Important point to note

When doing number work it is important that the children sit or stand so that they can see the numerals the right way up. It is not a good habit to sit children opposite each other at a table when numbers or letters are being used or written, because each child will then see the others work upside down and can lead to reversal problems.

Take special care to note where the children stand or sit during group exercises. The teacher can be on the wrong side of the work, but the children must stay on the side to see the work the right side up and should not stand beside her. This also applies to the younger ones who wander up to watch even if they have not yet reached the stage of the exercise that the others are doing.

Control of Error:

The rods act as the control of error because the quantities are fixed, and if put in a stair they will be in the correct length and number order.

Age: 4 years +, after the sand paper numerals have been introduced.

THE CARDS AND COUNTERS

Description of Material:

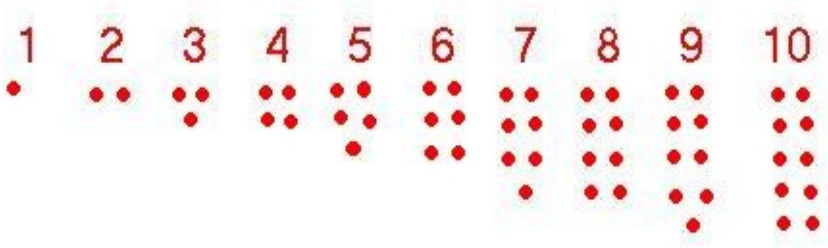
- A set of numeral cards 1 to 10
- A box of 55 counters all the same colour.

Objectives:

- To build up a sequence of numerals, putting the correct quantity below each numeral
- To give the child a visual representation of odd and even number in preparation for learning these terms later
- To give the child practice in counting and associating the correct number of objects with the numerals
- To prepare the child for the idea of the divisibility of numbers

Presentation:

- Bring the materials to the worktable
- Put out the cards randomly, then ask the child to give you the number “1” card, place card on top left hand corner horizontally.
- Repeat this activity and let the child finish sequencing the cards.
- Then point to each number saying, “This says 1, give me one counter”, then the child gives you one counter, place counter under symbol.
- Then point to 2 and do the same process till you have placed the counters for 1 to 5.
- Let the child do 6 to 10



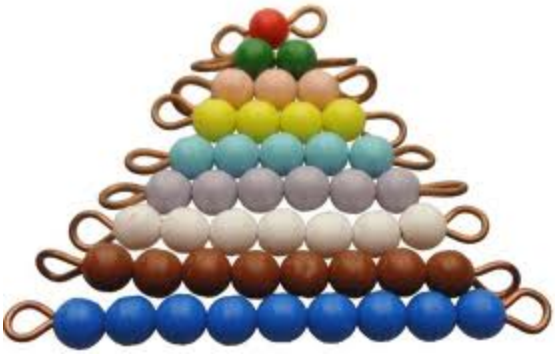
Control of Error:

Since the exact number of counters needed for this exercise is what is provided, if there are left over or not enough counters at the end the child knows that an error has occurred and can then correct themselves.

Age:

4 years + (After working with the Spindle boxes)

SHORT BEAD STAIR



Description of Materials:

- A set of coloured Bead Bars ranging from one to nine beads threaded on wire
- A small felt cloth

Objectives:

To introduce the child to this material in preparation for the Sequin Boards and Addition exercises.

Presentation:

- Show the child where the material is kept on the shelf, carry to the workstation and name the materials.
- Place the short bead stair at random on the felt cloth
- Show the child how to build the beads into a triangle.
- Count and place the beads in the form of a triangle one after another
- Show how to build from 1 to 3, invite the child to continue building the triangle.

An Extension:

Reinforce the colours of each number by playing a game.

Pick up two bead stairs, hide behind your back, name the colour and ask 'how many beads are they?

Then again you could ask " In my right hand the beads are purple, how many beads are there?" Play this until the child can remember the colours of the Bead Stair.

INTRODUCTION OF UNIT AND TEN

Description of Materials

- 1 Ten Bead Bar
- 1 Golden Bead
- A felt cloth

Objectives:

To introduce the child to this material in preparation for the Seguin Board exercises

Presentation:

- Show the child where the materials are kept on the shelf, name them and carry to the work station
- Place the Ten Bead Bar and the golden bead on a small felt cloth placed on the table
- Use the Three Period Lesson to teach the child "Ten and Unit"
- First period: "This is 10" point to the Ten Bead Bar.

"This is Unit" point to the Golden Bead

- Second Period: "Show me 10", "Show me Unit"
- Third Period: "What is this?"
- Return the materials to the proper place on the shelf and remind the child that he can work with the material whenever he wishes.