

# Montessori math materials progresses essay sample



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Mathematics is all around the young child from day one. For example certain matters like “ How old are you?” “ You were born on the 2nd” “ I have 2 brothers”. Number itself cannot be defined and understand of number grows from experience with real objects but eventually they become abstract ideas. It is one of the most abstract concepts that the human mind has encountered. No physical aspects of objects can ever suggest the idea of number. The ability to count, to compute, and to use numerical relationships are among the most significant among human achievements. The concept of number is not the contribution of a single individual but is the product of a gradual, social evolution. The number system which has been created over thousands of years is an abstract invention. It began with the realization of one and then more than one. It is marvelous to see the readiness of the child’s understanding of this same concept. Arithmetic deals with shape, space, numbers, and their relationships and attributes by the use of numbers and symbols.

It is a study of the science of pattern and includes patterns of all kinds, such as numerical patterns, abstract patterns, patterns of shape and motion. In the Montessori classroom, five families with math are presented to the child: arithmetic, geometry, statistics and calculus. More precisely, the concepts covered in the Primary class are numeration, the decimal system, computation, the arithmetic tables, whole numbers, fractions, and positive numbers. We offer arithmetic to the child in the final two years of the first plane of development from age four to age five and six. “ If education is always to be conceived along the same antiquated lines of a mere

transmission of knowledge, there is little to be hoped from it in the bettering of man's future" -Maria Montessori-

The objective of Montessori is to develop the concept first. By using concrete materials during the early, sensitive years, the Montessori child can learn the basic concepts of mathematics and language. Montessori students use concrete hands-on learning materials that make abstract concepts more clear. Lessons and activities are introduced simply and concretely in the early years and are reintroduced several times during the following years at increasing degrees of abstraction and complexity.

All of the materials in the Montessori classroom have been specifically designed to attract the interest of the student, while at the same time teaching an important concept. The purpose of each material is to isolate a certain concept the child is bound to discover. Montessori believed that " what the hand does, the mind remembers". Concrete materials make concepts real, and therefore easily internalized. The student works abstractly (paper and pencil) when he or she has internalized the pattern and no longer needs the Montessori material. Maria Montessori believed that all humans are born with a " mathematical mind".

The use of concrete materials to learn abstract concepts and operations is fundamental to the development of the mathematical mind in the Montessori classroom as the materials represent abstract ideas. The materials can be felt and manipulated so that the hand is always involved in the learning process. This approach to math is logical, clear and extremely effective. It allows the students to internalize math skills by using concrete materials and

progressing at their own pace toward abstract concepts. Students understand and develop a solid foundation in mathematics. Later, as they master the concrete they begin to move to the abstract, where the child begins to solve problems with paper and pencil while still working with the materials.

Geometry too, relies on the concreteness of the materials. Traditionally, geometry is taught as an abstract series of rules, theorems, and propositions meant to be memorized by the student. Maria Montessori saw geometry as firmly rooted in reality. Her geometry curriculum uses concrete, sensorial experimentation that lead students to concepts through concrete

Concrete materials are not just used for math and geometry. The practical life activities in the Montessori preschool not only provide self-confidence and independence, but helps with concentration and memory which leads to more abstract learning in math and reading. Elementary students use concrete grammar symbols to demonstrate the parts of speech. Once they have mastered these, they move on to more abstract grammar work with the grammar boxes and sentence analysis. Timelines are another concrete material in the Montessori classroom. The materials found in the Montessori classroom play an important part in the development of the child. They provide a way for children to construct their own reality and awareness by presenting it first concretely and allowing the children to manipulate and discover the next levels of abstraction. “ We must convey to the child the belief that we have made mathematics ourselves, and that we re-make it every time we move, think, work or play.

We should help the child understand that it is simply part of our being human to have a mathematical mind". – Gettman D, Basic Montessori We recognize the sensorial education as the base of mathematics. Dr. Montessori said that children are sensorial learners. They learn and experience the world through their five senses. From this experience child abstracts concepts and qualities of the things with in the environment. So sensorial education helps the child to create a mental order of the concepts he grasps using his five senses. " Children of 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." – Montessori M, THE ABSORBENT MIND Montessori firmly believed that the ' hands' are the mother of skills. By providing Montessori sensorial materials to the child she convinced correct manipulation with quality and quantity would certainly create a lasting impression in the child's mind with the understanding of mathematics. The sensorial materials simply present three mathematics concepts of ten ness, geometry and early algebra.

Dr. Montessori convinced there are two things to be introduced before working with mathematics. " Before beginning mathematics work, the child must therefore do two things: explore and accept the notion of idealized things with isolated qualities, and gain practice in the requisite intellectual skills" – Gettman D, BASIC MONTESSORI. Montessori sensorial material helps the child to idealize things and isolate qualities. The materials and activities of perception of dimension specifically designed to isolate qualities. As an example the red rods have ten pieces of rods made out of wood, coloured in

red same height but only differs the length. After feeling and building the stair child understands that the each rod is different in length. The second presentation makes him aware that the shortest rod is the difference between the each rod. Childs intellectual skills are developed through both practical life and sensorial activities. As I said before from simple practical life activities of pouring beans from jug to jug up to more complex activities of sweeping have the qualities of repetition, calculation and exactness.

Sensorial materials also provide the child with same skills of calculation with pink tower and red rods and repetition with baric tables etc. The math materials at Montessori classroom has divided into six areas. Such as Introduction to numerals, introduction to decimal system, Introduction to teen board, Operation of decimal system, Introduction to recording and arithmetic table and finally abstractions. Many children tend to dislike math from very young age because they were directly introduced to the symbols and then they were asked to solve the math problems mentally. Dr. Montessori was totally disagreed with this system. She realized children first need to build the concept. " Knowledge is not a copy of reality. To know an object, to know an event, is not simply to look at it and make a mental copy, or image of it. To know an object is to act on it. To know is to modify, to transform the object, and to understand the process of this transformation, and as a consequence to understand the way the object is constructed."

By Piaget. Dr. Montessori also said ' What the hand does, mind remembers'.

Concrete material make concept real and therefore easily internalized. She realized if the materials can be felt and manipulated that keeps the hands always involved in the learning process. Therefore she realized the best way  
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of teaching mathematics to the young children is to progress from concrete to abstract. The very first math material to be present to the child is the number rods. Number rods are very concrete and help the child to feel and understand the meaningful counting. It is also not very new to the child as he has already worked with the red rods before. The only different is number rods are colour coded with red and blue, which helps the child to visually discriminate the difference in length and then to count the rod. Teacher present the material by a three period lesson, by repeating the same activity again and again child understands that two means two things and three means three things and so on and so forth.

When the child is thorough with the number rods and understands the real meaning of numbers one to ten teacher introduces the written symbols of one to ten through a three period lesson using sandpaper numerals. Now the child is working with the concrete materials to understand the quantities of numerals one to ten and then he knows the written symbols too. The next step is to teach him how to combine the quantities with the written symbols. This was done through set of fun games. Teacher gets the child to bring number cards and the rods to the mat and then gets the child to identify the concrete value (the rod) first and then find and match the number card with the rod. Next teacher requests the child to identify the number cards randomly and match them with the rods. This activity helps the teacher to observe how thoroughly child is familiar with the numbers.

The next two games help the child to understand the sequence of numbers.

When the numbers and the rods are randomly scattered on the mat teacher requests the child to identify the number rods in sequence and then match

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the numbers with it and build the stair then in the next activity child identifies the number cards in sequence and then matches with the respective rods and builds the stair. The activities and materials of the Practical Life area, as well as the child's training and development through the Sensorial Materials, give the child a concrete introduction to fundamental mathematical concepts as well as to the logical reasoning underlying them. In this way, as well as through his exposure in everyday life, the child is indirectly prepared for learning the mathematical concepts before these are presented to him through the mathematics equipment and activities.

Practical life preparation for Mathematics:

The exercises of Practical Life help the development of concentration and a sense of competence. These are essential for mathematics work as the child needs to have both the motivation and the ability to concentrate for long periods in order to complete the Maths activities. The presentation of the Practical life activities in an ordered and logical sequence e. g. the precise sequence of steps involved in polishing brass or shoe cleaning, encourages the development of mathematical thinking. All practical life materials are used in a set sequence, and the child must be precise and thorough in checking at the end of an activity to ensure that it is complete for the next child to use. Maria said, " The process of abstraction is by its very nature an individual one. No one can do it for another however much he may wish to do so." By allowing the children to discover patterns and rules for themselves through the handling of the materials, they are learning to progress from the manipulation of concrete objects to their symbolic

representation on paper. Systematic progress is made from the concrete to the abstract.

The child studies the relationship between objects which are necessary for her to understand shape (geometry cabinet), form (materials of dimension) colour (tablets) and to be aware of their interplay (knobbles cylinders), carrying out calculations, extracting abstract ideas from the qualities of matter (Baric tablets). The Sensorial Materials are designed to express these Mathematical facts and introduce algebra (the cube of the binomial) geometric relationships and finding area (constructive triangles) and fractions (small insets), which will be further explored in the Second Plane. Finally naming these Sensorial-Mathematical experiences helps to form clearer concepts and enable the child to communicate her experiences precisely. Reasoning within sharply defined limits provides the basis for intellectual, joyful abstraction and imaginative creations. In order to compare quantities precisely addition is necessary, so the child is introduced to Numeration which is conventionally difficult for the child to grasp and as a result of which many adults dislike Mathematics.

Montessori believed that we have a Tendency towards Mathematics and that if we can be taught it in a way which manages the difficulties it will be both enjoyable and simple for the child to handle. The first difficulties she identifies are that, 1. The succession of numbers and the placement of digits (units, tens, hundreds, thousands, decimals and the use of zero as a placeholder), 2. The sequence being not understood but simply memorizes the sequence, masking the difficulties but which causes even more problems to the child's understanding and confidence when it later when it emerges

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that the child has not grasped the basic concepts. 3. The nature of the unit itself – any entity we choose can be the ‘ standard unit of measurement’ and it often has other associations, so that seven coins can be ‘ one coin, seven times’, ‘ coins’ or the numbers ‘ one’ to ‘ seven’ with each cat being given a different number. This lack of understanding can be very frustrating for the child, teacher and parent and the more examples exacerbates the problem.

Montessori solves these problems by presenting the quality of the unit as ‘ an unbroken multiple’ by giving the child work with the ‘ Addition of Variables’, in which the whole object can be seen to be one object made up of many identical parts, a real life example would be that a sari measures 6 yards, while being one item, so a sari is an unbroken unit of the multiple of 1 yard. This unbroken whole is offered first with the Number Rods, developing from the child’s familiarity with the Red Rods. Later qualities are offered in loose identical unites, here they can be broken, this is known as the ‘ Arithmetic of Groups’. The child is helped to establish contact with counting thorough the ‘ Arithmetic of Variables” before the ‘ Addition of Groups’, allowing the child to form the concept of numeration. Before learning to evaluate quantities and count with understanding the child needs to understand;

1. The true meaning of a unit (standard of measurement)
  2. The role the unit plays in counting (How many units make a quantity) 3.
- The relationship between the unit and the quantities above it 4. The reciprocal relations between different quantities above the unit

After sufficient preparation direct help is sensorially offered for Mathematics. Objects with other associations (beads, marbles etc.) are not used, as they distract from the quantitative. The activators offer concrete opportunities to work, manipulate repeat and see the result of acting on numbers (operations). After the concrete has been understood a symbolic representation of these experiences is offered (the names of numbers and the numerals, then the numbers and symbols together). Abstraction and creative imagination result from the child's keen sense of reality and her ability to hold this understanding in her mind. The whole of Mathematics is offered first and later its parts, with one difficulty isolated and presented, moving step by step towards individual work and abstract understanding.