Curriculum, *in Montessori language, refers to the child's complete path through the first twelve years of life. It is a continuing study of how each child lives and chooses to learn, much more than it is an outline of what he must learn.*

Independence, concentration and purposeful activity are some of the elements of this path. Giving a baby, the young child, the older child freedom to explore, respecting his concentration in whatever he has chosen to work on, providing activities that command the use of his brain and hands working together - all these things are part of the curriculum at all ages.

No matter what the child's potential or future vocation, Montessori believed in giving him an overview of how the Earth was created and how every element of history came to be from the very beginning. Life is presented as a great puzzle with every piece, including each child, playing a vital part for the correct functioning of the whole. Each element contributes to the existence and well-being of the whole. This is called Cosmic Education.

This overview is divided into five Great Lessons : (1) *The Creation of the Earth*
(2) *The Coming of Plants and Animals*
(3) *The Coming of Humans, and their tools:*
(4) *Language, and*
(5) *Math and Invention*

The child from age three to six is invited, never required, to participate in motor and sensorial (not intellectual) activities which are fun, fulfilling and appropriate to her age and development.

Between the ages of six and twelve, the child is asked to do only that work which is required by her state's board of education. Beyond that she is free to explore, inspired by lessons and presentations, materials and books and her own natural curiosity, in whichever directions her natural talents and interests may lead.

In the first few weeks of the each year in a 6-12 Montessori class, the five Great Lessons are presented with experiments, timelines, charts, etc., to the whole group. These inspire the children to further research on their own or in small groups which they may form. It becomes obvious that everything man may choose to study has a relationship to everything else. An interest in one subject can lead to an interest in almost anything else.

The 1st Great Lesson

Formation of the Earth

Experiments, models, charts, ~~research papers, field trips, reports~~ which may include poetry, drama, dance and any other form of creativity, express the child's research and understanding of the Creation of the Earth. The 6-12 teacher gives a presentation in the beginning of each year which may last for days, in which he presents the story of the creation.

The work that is inspired by this First Great Lesson continues through the year as children study Physics and Chemistry, Geology and Astronomy, whatever direction each chooses to go. The teacher does not require specific work, but guides the children as individuals or self-formed groups in doing research following their own interests, and in creating and finishing reasearch projects and in finding a way to express them.

The 2nd Great Lesson

Coming of Plants & Animals

For the Elementary child this study begins with a great, inspiring lesson given in the beginning of the year with experiments, charts, stories, a long timeline of the evolution of plants and animals from the beginning to the present, all "Keys" to inspire the child's own research.

The work revolves around the evolution of plants and animals, their needs and how they are satisfied, the functions of the organisms and their various parts, and the classification of the amazing and wonderful variety of life on earth.

The 3rd Great Lesson
Arrival of Humans

In the beginning of each year the third great lesson is presented, introducing the study of humankind with charts, timelines and research guides. The child moves from the general to the specific:

Age 6-8, the emphasis is on prehistoric life, the development of the physical environment and plants and animals, as we saw in the Plants & Animals section.

Age 8-10, the emphasis is on early civilizations, from tribal cultures and ancient civilizations to the development of modern cities. The child also learns to represent time graphically, BC/AD, etc.

Age 10-12, the emphasis is on the child's national and state history.

Of course all of these studies are going on at the same time and the child is free to follow her interests, no matter what the age.

The history of people on Earth is taught through the study of the physical and spiritual needs and the mental tendencies of humans. The physical needs are for food, clothing, shelter, transportation and defense; the spiritual needs are self respect and self love, love of others, . The mental tendencies are toward exploration, orientation, order, exacting work, perfection, invention and communication.

The history of humans is studied both objectively and subjectively. For example, as the child learns about how people obtained food in the past, he learns to grow and prepare that and other food. As he learns about clothing of the past, he may learn to knit or to make costumes. As he learns about the lives of famous and not famous explorers of the past, he himself explores in many directions. He studies the arts of the past while developing his own musical and other artistic talents;

The 4th Great Lesson
Language

The fourth great lesson introduces the exciting exploration of language. It is given in the beginning of each year in the 6-12 class to touch the imagination and start children on their research.

Through stories, charts and beautiful, carefully chosen books, we enable the child to begin to understand (1) the path traced by language, the growth and development of language - through travel, colonization, commerce, war, etc.; (2) How humans have given a name to everything found or made and how this process continues; (3) How language constantly changes and why; and (4) that language is an expression of the creative force of humanity.

For the child's own use of language, we do not require him to read and write every day, but we fire his imagination in all subjects so that he thirsts for information and is forced by this to explore through reading and to express, record and communicate his discoveries through writing.

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The 5th Great Lesson - Math & Invention

In the fifth great lesson in the beginning of each year, the elementary children are introduced, with stories, books, examples, to the exciting history of math.

Objects were first kept track of, not by counting, but by comparisons, a notch made in a piece of wood as each sheep returned home, a stone put in place for every member of the group. When actual counting began it was associated with parts of the body, as in base ten from our ten fingers.

It is important that we help the children realize that mathematics has evolved and is still evolving from a practical need and the spoken and written language of math from the need to communicate that which was calculated.

Geometry arose from the practical need to reestablishing planting boundaries after the annual flooding of the Nile in Egypt. In "geometry," "geo" stands for "earth," and "metry" for "measure." Children of this age love to reach back into history with their imaginations and reconstruct these needs and solutions and the creation of language. The Hindus introduced the use of "0." Let the child try to do math without it!

As a result of this lesson, the children will want to invent their own math and geometry. They will make up their own problems for themselves and their friends and come to a very clear understanding of the function and value of this area of knowledge.

GREAT LESSONS AND COSMIC TALES

Introduction

Maria Montessori believed that elementary age children have a wonderful imagination and an immense desire to learn. She knew that children at this age love stories and found that stories about important, rather than trivial, topics fascinate them and inspire them to intense study in areas related to the themes of the stories.

The core of the Elementary curriculum is to provide children with an appreciation for their individual roles in the world as human beings, and to celebrate the contributions of generations of humans over a relatively short period of time in geological terms. Human life emerged in specific environmental conditions and remains dependent on geological and biological factors. Children are taught to respect all organisms, each of which fills a necessary ecological niche accomplishing its own cosmic task.

In 1958, Montessori's son, Mario M. Montessori, reconstructed his mother's story of God's creation of the universe, the story known as "God Who Has No Hands". This story was provided to students at the International Center for Montessori Studies in Bergamo and has since been published. (Lanaro: History Manual I, MMRF, and Sisters of Notre Dame: History Manual)

With further development of Montessori elementary curriculum, led by Margaret Stephenson at the Washington Montessori Institute (AMI), this story became the first of five Great Lessons, which introduce children to the major areas of human knowledge and provide a framework for all areas of study. These lessons are presented as inspirational stories, providing a dramatic introduction to the broad topics or themes, which are the central organizing force for the integrated curriculum. In this respect, the term "Great Lessons" may be confusing. Each is a story which sows the seeds of interest and offers an overview. Follow-up activities, known as "key lessons", are lessons in the traditional sense, presenting the children with learning materials with specific content.

The topics of the five Great Lessons are:

I. Creation of the Universe / "God With No Hands"	(The origin of the physical universe)
II. The Coming of Life / Earth's Preparation for Life	(Biology)
III. The Coming of Humans	(includes Needs of People and History)
IV. The Invention of Writing	(may extend to all language, incl., speech)
V.The Invention of Numbers / Mathematics	(may extend to Science and Technology)

Each teacher may present his/her own version of each story. What is important is that the story should stimulate the imagination of the children, so that they are excited, intrigued and inspired to find out more. Thus, the teacher should use all his/her story-telling skills to make the story dramatic and memorable. Reading the story does not work well. Many teachers like to present these stories to the whole class in the first two weeks of the school year. For new children, this is a novel experience; for returning children, it is a welcome retelling of a well-loved tale and their anticipation adds to the sense of a special event.

These topics are obviously very broad and the story-telling session must focus on a few major ideas. The story might in fact be told in installments over several days and be preceded or interrupted by demonstrations or experiments. After the story, the children may choose to retell or elaborate on the stories in writing, art work or drama and they may ask questions that require the teacher to indicate further resources. The teacher will give additional "Key Lessons" to individuals and small groups, which develop the topic in greater depth.

Because the topics of the Great Lessons reflect fundamental human questions, beliefs of different cultural traditions are quite diverse. The teacher must take care that the story he/she tells should respect the religious heritage of the children in the school.

FIRST GREAT LESSON: CREATION OF THE UNIVERSE / GOD WITHOUT HANDS

This story responds to the eternal question " Where does our world come from?" and reconciles belief in God's primary role in creation with a scientific explanation. Montessori assumes that children who have learned that God is a spiritual entity might question how a being without a body can make anything, let alone the world and everything in it. She explains that God created special laws or rules which everything that exists must obey.

She then describes the creation of the earth from a scientific standpoint, each development ensuing from a fundamental principle of physics or chemistry. In order to aid the imagination of children in conceptualizing such cosmic events a series of twenty demonstrations of scientific phenomena were developed together with a set of illustrative, and sometimes fanciful drawings known as the "impressionistic charts". Each scientific demonstration or experiment should be experienced by the children before they are told the relevant part of the story, so that the teacher can refer to that experience. Sometimes the teacher or an assistant gives a demonstration during the story-telling session.

The main points of the story and the "Laws of the Universe Experiments " (demonstrations or experiments that illustrate divine or scientific law) are listed below.

Note that this Montessori traditional lesson includes ideas, demonstrations and illustrations that must be updated and modified for presentation in contemporary classrooms in the USA. In most schools, both public and private, there there must be clear separation of secular and religious instruction. Also, some chemicals and activities used in the science demonstrations are dangerous.

Key Points of the First Great Lesson:

1. COLD AND DARKNESS OF SPACE
" In the beginning, there was only darkness and cold. It was darker and colder than anything we can imagine."

DEMONSTRATION 1: COLDER THAN COLD:
Ice is cold. Add salt and it is even colder.
LAW: There are temperatures even lower than the temperature of ice.

2. THE FIERY MASS / BIRTH OF STARS
"In the vast space of nothingness appeared a fiery mass. It had more heat and light than anything we can imagine. It was so hot that everything in it was a gas. Everything that is in the universe today was in it. As the mass moved through space, pieces fell from it, including the stars, our sun and the earth. They all move through space according to special laws."

DEMONSTRATION 2: DROPLETS:
Drop alcohol into oil and water to show droplets.
LAW: Celestial bodies spin in space like droplets.

CHART 1A: Earth vs Flame of Sun *(MODERN CHARTS: Pictures of galaxies)*

CHART 2A: Planets

3. STATES OF MATTER

"The earth was a blazing mass of particles of many kinds. As they cooled, they became rock or water or air. (solid, liquid or gas). Different substances change at different temperatures and some particles are able to combine with other particles."

DEMONSTRATION 3: SOLID, LIQUID, GAS
Containers with a solid (glass), a liquid (water), a gas (air). Labels.
LAW : There are three states of matter: solid, liquid and gas.

DEMONSTRATION 4: VISCOSITY
Add sugar to water: "viscous" is between liquid and solid.
LAW: When a substance begins to become solid, it first becomes viscous.

DEMONSTRATION 5: HEATING - SOLID TO LIQUID TO GAS
Melt wax to demonstrate " liquid" becomes "gas" as it is heated.
LAW: When matter is heated, it changes from solid to liquid to gas.

DEMONSTRATION 6: COOLING - GAS TO LIQUID TO SOLID
Melt ice over heat, then boil with lid on and refrigerate the drops.Melt wax then drop it in ice water.
LAW: When matter is cooled, it changes from gas to liquid to solid.

DEMONSTRATION 7: SOLUTIONS and MIXTURES
Stir sugar into a cup of water and chalk powder into another to demonstrate solutions and mixtures.
LAW: Some particles are attracted to (love) each other and stay joined.
Others easily separate.

DEMONSTRATION 8: MIXTURES - SEPARATION WITH MAGNETS
Mix iron filings and sand. separate with a magnet.
LAW: When combinations of substances can be separated, they are called "mixtures".

DEMONSTRATION 9: CHEMICAL COMPOUNDS
Combine ammonia and hydrochloric acid to make the gas ammonium chloride. *DANGEROUS GAS*
LAW: When substances are mixed, a new and different substance may be created.

DEMONSTRATION 10: CRYSTALLIZATION
Heat copper sulphate and water. Immerse a piece of copper sulphate on a thread. Allow to cool. *DANGEROUS*
LAW: When matter changes from liquid to solid, it may form crystals.

DEMONSTRATION 11: CHEMICAL REACTIONS and HEAT
Add sulfuric acid to sugar to produce carbon. *DANGEROUS*
LAW: When chemicals are combined, heat may be generated.

DEMONSTRATION 12: CHEMICAL REACTIONS and PRECIPITATION
Dissolve calcium chloride in water and add sodium carbonate, producing salt.
LAW: When liquids are combined, they may create a solid (precipitate).

4. PROPERTIES OF SOLIDS, LIQUIDS AND GASES
"Some particles form a solid body that stays solid even when pieces are chipped off. Liquids take the shape of the container. Gas particles do not cling together and move freely. "

DEMONSTRATION 13: PROPERTIES OF SOLIDS, LIQUIDS AND GASES
Observe a piece of glass and a piece of wood. Pour water into different shaped containers. Open a bottle of ammonia and observe.

LAW: Solids have shape. Liquids take the shape of their container. If they overflow they go in all directions except up. Gases have no shape; they tend to occupy maximum space and expand in all directions.

DEMONSTRATION 14: RIGID, ELASTIC, PLASTIC
Apply pressure on marble/stone, rubber ball, plasticene. Label.

LAW: Matter which keeps its form under pressure is "rigid". Matter which changes its form but returns to its original form is "elastic". Matter which does not change back is "plastic".

5. MATTER CHANGES STATE AT DIFFERENT TEMPERATURES
"When it is very, very hot, everything becomes a gas. When it is very, very cold, everything becomes a solid. But at in-between temperatures, some things will be solid, some liquid and some gaseous."

DEMONSTRATION 15: TEMPERATURE CHANGES AND STATES OF MATTER
Heat wax, tin, lead and iron. Leave ice on a dish. Observe.

LAW: All matter changes state, but different things change at different temperatures. (Each has its own special properties/characteristics.)

6. WEIGHT, DENSITY AND GRAVITY
"Everything has weight, but not everything has the same weight. Heavier things attract lighter things."

DEMONSTRATION 16A: DENSITY, LAW OF GRAVITY
4 colored solutions of salt with different percentages of salt. Combine pairs for 12 different mixes and observe.

LAW: Denser liquids sink to the bottom, lighter ones rise to the top.

DEMONSTRATION 16B: GRAVITY
Cover ping-pong balls with sand. Add iron and lead objects. Cover with cloth and shake vigorously.

LAW: Heavy bodies sink to the bottom. Lighter ones float to the top.

7. FORMATION OF THE EARTH

"Everything obeyed these laws that God made. The earth, the sun and the stars were balls of gas and everything that makes the earth, the sun and the stars was in the gas. They moved through space which is very, very cold. So they cooled down and small balls cooled faster than large balls. This is why our earth is quite cold outside now and the sun is still blazing in the sky.

The earth started to cool down and the gases it was made of first turned to liquid, then to solid, each at its appointed temperature. Their particles joined with other particles and formed new compounds. The heavier liquids sank and the lighter ones floated on top, but they were all attracted down to the heaviest. And the whole earth continued on its course, spinning around the sun.

The outside of the earth cooled more, but the center was still very hot liquid. The earth looked like a ball of fire. It was like the sun today. Some layers around it were liquid and some were viscous. The pressure of the outside layers made the inner layers more solid, but liquids and gases kept pushing through. Flaming gases were all around. When things get hot, they expand and get lighter, so they rise like bubbles of air in water. When they cool down, they shrink and get heavier, so they sink like grains of sand in water. So when the hot particles of the earth got thrown up to the outside of the earth, they got cold from cold space and fell back into the raging fire. Then they got hot again, and rose, and got cold again. Millions and millions of tiny particles, too small to see , obeyed the laws of physics and we call this the **Dance of the Elements.**

This is how the earth gradually cooled down and changed from a ball of fire to our earth today. As it shrank, its surface got wrinkled like an old apple. The high places are the mountains and the oceans are in the low places.
The world spins round and round, and turns around the sun, just as it has done for millions of years. The earth and all its elements fulfil their appointed task and whisper: "Lord, they will be done, we will obey!"

DEMONSTRATION 17: VARIABLE COOLING
Pour hot water into large and small bowls. Smaller cools first.
LAW: Small masses cool faster than large masses.

DEMONSTRATION 18: VOLCANO
Pour bicarbonate of soda and vinegar into crater of clay volcano.
LAW: Expanding substances force their way out of a confined space.

DEMONSTRATION 19: MATTER EXPANDS WHEN HEATED
Show metal object fit through hole of box. Heat it and try again.
Heat water in corked flask.
LAW: All matter, including gases, expands when heated.

DEMONSTRATION 20: QUICK EVAPORATION
Pour drops of water onto a hot tin plate.
LAW: Liquids change faster to gas when they are very hot.

CHART 3A: COSMIC DANCE OF THE ELEMENTS
CHART 4A: VOLCANOES - cloud
CHART 5A: VOLCANOES - water
CHART H5: **KEY LESSON - CLOCK OF ERAS**

SECOND GREAT LESSON:
THE COMING OF LIFE
Earth's Preparation for Life / The Coming of Plants and Animals

The following story has been adapted from the teaching of Sister Aloyse.

"Remember the story of the Creation of the Universe?
The earth cooled and looked like a tiny pearl. It was so beautiful The sun just kept looking at it. Then one day, something happened. It started to rain and rain. The rain washed the rocks and washed salt from the rocks. Big seas appeared and they were salty. More and more rocks got washed into the sea. it seemed as if the earth was breaking up.The sun wanted to know who was responsible.

Water said,"It's not my fault. Air stirs me up."

Air said, " My job is to cover the Earth with layers of blankets so she does not get cold. Earth has such a big tummy and frozen feet, so I am always running. Water jumps on my back and takes a ride. I have to drop her when I climb up the mountains. It's the Rocks fault. They never move to let me pass."

The Rocks said, " Do not blame us. We are just sitting around. It's not our fault we get hot. It's Sun's fault."

Of course, they were all correct. Each one was behaving according to the laws of her nature. But something has to be done.

A tiny, tiny drop of jelly appeared in the water. God said: I give you senses and your law is to eat, to grow, and to make others like you.

These little blobs of life began the work of cleaning the seas. They built shells to protect themselves, using calcium that was in the salt water. When they died their shells lay on the bottom of the sea and made a new sort of rock. Time passed and more and more layers of rock were made from these shells. The layers are like pages in a book. We can read some of those pages to know what animals were in the sea.

The first creatures had only one cell, but they could breathe and eat and clean the water as they drifted in the sea. After a long, long time, some of them had an idea. If they got together, they could work better. Some could do the breathing, some could do the eating and some could do the moving. They could cooperate. So some creatures had many specialized cells, and some had mouths and hearts and other organs. We can find all these creatures in the book of the Earth."

CHART - TIMELINE OF LIFE
(Show and describe early creatures: **amoeba, flagellates, sponges, anemones, trilobites.**)

"As time went by all sorts of animals appeared. Some had legs on their heads. Some looked like flowers on stalks, some made shells from the salts of the sea.
Then one day, some creatures landed on the rocks near the water's edge. They liked it there and they started to grow cells that could breathe air. They were the first **life on land.**

In the sea there were new kinds of animals. **Corals** and animals with a kind of rod inside their bodies. This was the beginning of a backbone and these animals were a kind of **fish.**
In some places the water started to dry up, so the fish that lived there were dying. But some had a small sac in their bodies and they used it to breathe air. These were the first **amphibians.** They could go out on the land. They did not need fins on land and their fins became legs. They are the **frogs** and **salamanders.**

Now a very exciting thing happened. The only sounds until now were the sound of the wind and the rain and the sea, but the frog had a **voice,** and that was the first animal sound!

There were **plants** on land and many **insects,** so there was plenty for the amphibians to eat, but they had to stay near water to keep their skin moist and to keep their eggs safe. Some new animals appeared with tough skin that would not dry out and they laid eggs in shells for protection. These were the first **reptiles.**Soon there were many different sorts of reptiles, including **dinosaurs.** Some were huge and some were small. There were also little furry animals. They were the first **mammals.** Their fur and warm blood helped them live in cold places. Also they kept their eggs inside their bodies instead of laying them, so the eggs could stay warm. Some animals appeared who had another way to keep warm. They were the first birds.They had feathers to keep warm and they kept their eggs warm by sitting over them on nests.

There were times when the weather was very warm and times when it got quite cold. One time, it got cold for a very long time and the dinosaurs and many other reptiles died out . The mammals had more space and great **pigs, hippos** and **elephants** appeared. Then there was another **Ice Age.** Many giant mammals became extinct.

But now a new sort of animal appeared. It had a very large brain. It had the power to think and it had a great power to love. It was not just an animal; it was a **human being.** If humans had arrived earlier, the earth would not have been ready for them, but now everything was ready, so they could live on the beautiful earth.

If the earth had a voice, it would have said:

I have spread a thick carpet of grass for your feet.
I have put flowers in my hair.
I have covered myself with pearls.
My cupboards are full of fruits, meats and vegetables.
In my cellars are coal and iron.
All is ready. Come! "

CHART H3: Brontosaurus
CHART H4: Tyrannosaurus
KEY LESSON - LONG BLACK STRIP / GEOLOGIC TIMELINE

THIRD GREAT LESSON: THE COMING OF HUMANS

The purpose of this lesson is to focus on the special attributes of human beings with an emphasis on the short a time in geologic terms that humans have lived on earth. This lesson prepares the child for the later lessons which celebrate the remarkable achievements of human societies which developed writing, mathematics and the body of knowledge and skills that we have inherited and to which each one of us can make a contribution for the benefit of future generations.

The following outline notes the key points to be made by the teacher. (Shared by Sr. Aloyse.)

1. REVIEW THE TIMELINE OF LIFE

"Remember that at the end of our Timeline of Life there was a picture of a human being! The earth and the land and the water settled down. But then there was another problem. Life came to solve the problem. Little, tiny animals made the water clean again. Then plants came in the water, and then on the land. And later, larger animals came. Frogs came and the voice of the frog was heard. Birds began to fly, They built nests and sang.

Then, the earth was ready, and a human being came, a person like us. When we looked at the long Black Strip, we could see what a long time there was before there were humans. "

2. DISCUSS THE CHARACTERISTICS OF HUMANS

Mind:
Humans are very special. We are animals, but we are different from other animals. We can think. We have a mind.

Creating Stories: When humans came, they saw the sun and felt its warmth, and they felt the wind blow, and felt the rain. They wondered about those things and how they happened. They made up stories about what happened.

Love: Humans can think and we can think about people we have never seen, like the people who do not have enough food. We can wish they were not hungry. That is a sort of love. Humans can love.

Food: Plants and animals only eat certain things, but humans eat all kinds of things.

Shelter:
Birds build special nests to live in, but humans can live in all kinds of places.

Hands: Humans have hands. And we walk on two legs so our hands are free and we can use them.

3. KEY LESSON: TIMELINE OF HUMANS
Discuss the picture of a **hand** - holding a stone tool.
Discuss the last short red section - **Writing** - humans have only had writing for a short time.

CHART H1: Fundamental Needs - General
CHART H2: Food

FOURTH GREAT LESSON:
THE STORY OF LANGUAGE AND WRITING
The little piece of paper that could see and speak

The topics of the fourth and fifth great lessons introduce the child to the amazing inventions of people. The goal is to help the children to appreciate that writing and numbers are creations of human beings, and that every generation can add to the store of human knowledge and invention. Each individual has a role to play.

There seems to be no particular traditional story for fourth lesson on language. Teachers have developed a variety of stories to stimulate the child's awareness of the special power of words and especially of the written word which enables humans to communicate their thoughts over time and space.

The following notes offer ideas from Sr. Aloyse and Michael Dorer for developing stories for this lesson.

INVENTION OF SPOKEN LANGUAGE

Ask children to imagine they are cave people. It is a long, long time ago. There were no cars, no televisions, no stores, no streets, not even any houses - and no languages. People live by hunting, gathering and fishing.
Ask children to mime how they live. They may not use words to communicate. Use signals or make sounds/grunts instead. Discuss how first words may have arisen - in anger, or naming.

The first word broke the silence of centuries. Each family evolved its own simple language. Words are human inventions. We agree to accept a word/sound to mean one thing.

WRITING

Discuss any signs used by children in the cave mime above. (Ways to tally hunting quantities etc.)
Ask children to think how they can communicate with people far away (before telephones & computers)
Discuss signs, mailing letters and reading books - communicating with people far away and at a different time. Imagine what signs were first used for: warnings? directions? tallies? ownership?
Introduce pictographs and petroglyphs

THE PIECE OF PAPER THAT SEES AND SPEAKS

This story emphasizes the mystery of writing, where marks on paper give information that has not been spoken. (Note that Montessori uses "secret messages" extensively in language and math lessons.)

- A gardener grows some beautiful pears and decides to send them to her friend in the next village. She puts the pears in a basket with a letter and gives them to a child to take to her friend. On the way the child is hungry and eats a pear. He arrives and gives the basket to the friend who reads the letter and says that one pear is missing. The child asks how the friend knows this. The friend explains that the paper told him. The child wonders how a paper knows he ate a pear. How can the paper talk? The following week, the child is sent to deliver pears again. This time he eats a pear and hides the letter under a rock. The friend does not know that a pear is missing. The child tells village elders that the gardener and her friend know magic. They confront the gardener, who is happy to show them the secret of writing and reading.

KEY LESSON - History of Writing

Ideographs, Egyptian Hieroglyphics, Sumerian Cuneiform, History of the Alphabet

CHART / CARDS: HISTORY OF OUR ALPHABET

FIFTH GREAT LESSON:
THE INVENTION OF NUMBERS
Mathematics and Scientific Inventions

The goal of the fifth great lesson is to help children understand that mathematics was invented by people, and that like language, it is still being developed. As with the fourth great lesson, there is no single story associated with this lesson. Just as the children are shown early alphabets, they are shown early counting systems and numerals. In specific mathematics and geometry lessons, the teacher often tells stories how ancient Romans, Greeks and Egyptians found mathematical solutions to problems.

Discussing the Power of Numbers and Numerals
The following ideas focus on historical methods of keeping count. Research into old ways of counting is a good activity for upper elementary children.

- Early humans did not count. They knew the time of day and night by looking at the position of the sun, moon or stars. For small numbers it is easy. If we have two, we can say we have a pair, just as we have a pair of eyes, a pair of legs, etc. For three or more, it is a little harder, we say we have" several" or 'many".
If a man wanted to know if he had enough animal skins for his family to sleep on, he would share them out: This for you, this for you, etc. That is matching with one to one correspondence. As they lived in larger groups they needed to find ways to keep track of food and possessions.

Ways to Keep a Count:
Comparing the Size of Two Herds of Cattle
Drive each herd through parallel gates. The smaller herd will be in its enclosure first.
Pebbles
A boy takes the family sheep to graze on the good grass in the daytime and he is supposed to find them all when he comes back in the evening. If he doesn't know how to count, he cannot count to see if he has lost a sheep. One way to find out is like this. When you set the sheep loose, pick up a pebble for each sheep and put the pebbles in a bag. Then, in the evening when you collect the sheep, take one pebble out of the bag for every sheep that goes into the corral. If there are any pebbles still in the bag, you have to go back to find the other sheep.
Notches
Another way to remember how many animals you have is to make notches on a stick, one for each sheep. Pairs of notched sticks were used until recently in Europe at bakeries. A notch was cut across two sticks each time the customer took a loaf. The baker kept one stick and the customer had the matching one. At the end of the month, they both know how many loaves were taken and how much to pay.
Knots
Knots can be tied on strings to record number quantities.The Incas used a system with different color strings and knot sizes to record taxes. (quipus)

Early Written Numerals
Charts and cards showing historical systems of numeration:

Washington Montessori Institute Charts:
M1 Malaya - one stone represente the quantity of one, etc.stones
M2 Babylonian Numerals - cuneiform - wedge-shaped marks in clay
M3 Egyptian Numerals - hieroglyphs represent decimal system categories
M4 Greek Numerals - using letters of the alphabet
M5 Roman Numerals - still used today, but not for calculation
M6 Chinese Numerals - based on sticks laid horizontally
M7 Old European Numerals - from Hindu-arabic
M8 Changes in our Numerals - modifications of arabic numerals
M9 Decimal Numerals