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SEDIN

Creative Methods for Successful Inclusion
in Multicultural Schools

Waterpark Montessori International

Training of Trainers Guide

*Adapting Montessori Principles for the
Implementation of the SEDIN Project*

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1. Introduction – Montessori and the SEDIN Project

From www.sedin-project.eu:

“In its early stages, the Montessori Method played an important role in social inclusion. The children that Maria Montessori taught were considered as almost “lost cases” that could not learn how to become members of the society. However, the Montessori method since it is based in independence and cooperation can provide children with the knowledge and skills they need to live in the society and to develop self-discipline and independence. The Montessori method is also enabling the children, through habit and through practice to perform easily and correctly the simple acts of social or community life. The discipline to which the child is getting used is not limited to the school environment but extends to society. Through the concept of self-discipline the child learns independence and practical life skills which will allow him/her to live as meaningful members of the society. The knowledge and skills that the children will acquire following the Montessori’s vision are sensory education, manipulation of the environment, practical life skills and self-discipline. Another aspect of the Montessori method which is important for refugee children (as well as for children of migrant/minority background) is the integration of family into the learning process. According to the Montessori approach, the places where children live, and the schools constitute social processes and it is important to educate children in both concepts.

Over the years the Montessori education has become expensive and is usually accessed by the parents of children from more privileged backgrounds. However, the transfer of the Montessori method for issues of social integration will be very beneficial for the children of refugee/ migrant/ minority background. The project is not aiming either to train Montessori teachers nor to transform the multicultural schools to Montessori schools since this not possible for many reasons (including legislation). However, it aims to promote the inclusion of elements, principles, values and tools of the Montessori method to the schools in order to foster the autonomous and creative learning in multicultural classrooms.”

1.1 *Outcome objectives of the SEDIN project:*

- Pupils feel a greater sense of belonging in their class / school (refugee/migrant/minority)
- Pupils participate more in lessons (all pupils)
- Pupils interact more with each other (all pupils)
- Pupils engage in activities with less reliance on the teacher (all pupils)

1.2 *Challenges, as identified by teachers:*

- Language/Communication
- Family participation
- Cultural differences

Throughout the training course we will refer back to these challenges and objectives, and will discuss how to use Montessori principles to address them.

2. Montessori in a Nutshell

2.1 *A Brief Overview of the Montessori Method and Underlying Principles.*

Montessori in a Nutshell, by Clare Healy Walls, is provided as a supplement with this manual for the SEDIN training of trainers. Please read as a companion to this guide.

Copies also available for order on amazon.com

Montessori in a Nutshell is not eligible for copy or distribution without permission of the author. All translations of Montessori in a Nutshell remain the property of Waterpark Books.

2.2 *Relevant Videos & Articles about Montessori education (links):*

A Montessori Morning: <https://youtu.be/09Y-huCMjlc>

What is Montessori? | In 18 Minutes <https://youtu.be/Ljuw3grZ11Q>

A Community Meeting at Mission Montessori <https://vimeo.com/258891123>

“Work I’m Proud” of Presentations at Mission Montessori” <https://vimeo.com/258887659>

A Morning Work Cycle at Mission Montessori <https://vimeo.com/258898021>

The Children's School Montessori <https://youtu.be/pemp042Kf5A>

Developing Norms for Successful Collaboration during PBL: <https://tinyurl.com/y8uudlhk>

3. Discussion Topics: Promoting Inclusion with Montessori Principles

Guidelines for discussion groups:

- One topic per session.
- The topics do not have to be worked in order.
- Approximately 2 to 2.5 hours per session, including a short break.
- Discussion groups of 3-7 people.
- The trained course facilitator will help discussion to follow the most beneficial format. If there is no trained course facilitator a timekeeper should be appointed to manage the use of time for the session.
- A member of each group reads the discussion points aloud. Take about three minutes for the group members to privately write down their thoughts or questions.
- Discuss each point as a group, allowing about 10-20 minutes per point.
- Refer to relevant Montessori theory and how these topics apply to the SEDIN project.
- Each participant should note their personal reflections (notes page following this section).
- About 20 minutes before the end of the session, return to the large group to share any thoughts or reflections.

3.1 Inclusion - Punishments & Rewards

- What is the difference between a punishment and a consequence?
- How can rewards be harmful to social inclusion and self-esteem?
- How do you approach different cultural attitudes towards punishments and rewards?
- What other motivators can you use as alternatives to rewards and punishments?

[illegible]

3.2 *Respecting Children and Young People*

- Do you find it difficult to give children their right whilst maintaining our roles as guides and protectors?
- Do you understand children's needs, or do we interpret them according to your own standards?
- Children are different but equal. Do you treat them as inferior or superior?
- How do you discover the needs of children? Do you find it easy to listen to them and acknowledge what they say? Can you talk TO children, rather than AT them?

Some simple ways to offer and teach respect to children and young people:

- Treat them as you would want them to treat you (even if they are not yet ready to treat others well). The most effective way to promote respect and equality is to model it.
- Greet them individually, with respect. When they arrive in the classroom, shake their hand (or whatever is the customary greeting in your culture) and look them in the eye, as you would a work colleague or friend. This applies for "children" of all ages. It is also a good way to model the habits of your culture and help children from other cultures to share their traditions, without much need for language.
- Ask yourself - is the action I'm about to take for my benefit, or for the benefit of the child? Even the smallest actions can be chances to offer and teach respect.
- Listen to what they say, and respect that their feelings are valid.
- Tell them the truth. Even if the truth is that you are not allowed to give them all of the information they may request!
- If you have behaved badly or lost your temper (we are all human) - apologise. Apologising to a child does not lessen their respect for you - it increases it. It shows them that you respect them and lets them know that apologies are important.
- Avoid interrupting them if they are concentrating (see point 1).

3.3 *Traumatised Children*

- How can we acknowledge and support the healing of traumas that may have been experienced by the children from refugee backgrounds?
- Empowering powerless children - everyday skills and independence
- Avoiding pity and “saviour behaviour”
- Empathy and understanding – avoiding blame

[illegible]

4. The Prepared Environment

The Prepared Environment

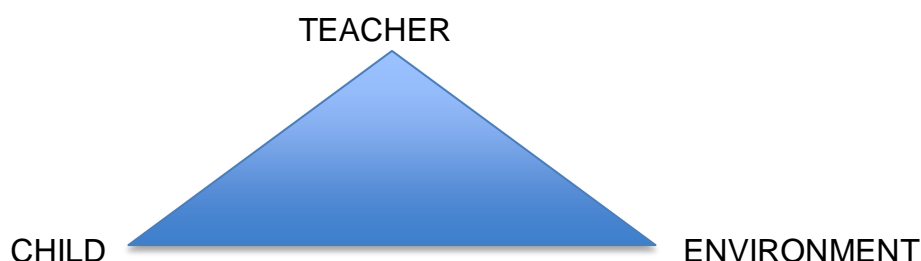
There are many Montessori principles behind the prepared environment. The environment is prepared so that it can implement the Montessori principles.

4.1 *The Environment is Prepared*

The underlying principle of Dr. Montessori's educational method is that the child learns by himself from experience within the environment. The role of the adult is to prepare that environment in order to maximize the value of the educational experiences within that environment.

Dr. Montessori believed that the child learned by interacting with the environment. This belief was shared by many other psychologists and educationalists. However, the aspect stressed by Dr. Montessori was the *preparation* of this environment in anticipation of the child's interaction with it. Other educational methods will prepare suitable developmental activities within the environment but there is less emphasis on the advance preparation of these activities. Activities are also a permanent part of the environment in a Montessori classroom. In planning for the child's learning the Montessori method puts more emphasis on the environment than on the interaction of the adult and child.

Dr. Montessori said that her system moved away from the old teacher-child relationship to a new relationship, as shown in the diagram below. The link between the teacher and the child is stronger in the beginning but becomes less strong as the child strengthens the link with the environment:



Preparation of the environment is an ongoing activity in a Montessori classroom. Most issues are dealt with through the environment, from behaviour problems to curriculum

planning. A Montessori teacher will spend more time on preparation of the environment than traditional teachers do.

4.2 *Independence & the Prepared Environment*

Independence is the centre of the Montessori curriculum for all ages. The aim of all education is to make the individual independent, but the Montessori method puts an extra strong emphasis on this. Given the importance of this principle and the fact that principles must be put into practice through the prepared environment, it follows that the environment must be prepared for independence.

It is essential that everything in the environment has been prepared so that it supports the child's move towards independence. Shelves must be placed so that children can reach them. In that way they can actually choose their own work. Furniture should be light enough to be movable by the children. We need to provide cleaning utensils so that the children can keep the environment clean themselves.

A teacher planning the environment should look to every detail in the child's activity, examining ways in which things can be changed or adapted to shift more of the activity from the adult to the child. We can give a nine-month old baby food that is suitably prepared and cut up so that he can feed himself. We can provide name labels and glue for three-year-olds who are not yet writing, so that they can label their own artwork. We can provide pencil sharpeners that are easy to use for 6-year-olds so that they can sharpen their own pencils. We can provide instruction cards and all the necessary materials in a basket for a simple science experiment for a 10-year-old. We can provide simplified versions of the national curriculum for the 14-year-old so that he can make his own study plan. And so on.

The importance of these small changes is far reaching. Take the pencil sharpeners for example. Remember, these pencil sharpeners must be easy to use and of good quality. When a child is shown how to sharpen his own pencil and is then given the means to do this, he learns many things: He starts to take responsibility for his own work. He develops a sense of pride in taking care of his own work. He maintains better standards in his work because he can fix his own pencil when it is blunt. He does not lose interest in his task because his pencil cannot be used and the teacher is busy. He can concentrate for longer periods. He has opportunities to develop his social skills as he learns to put the sharpener back so that others can use it. If he finds that it is not there for him one day because

another child has neglected to put it back, he learns in a meaningful way why we need to have rules for co-operation within a group. Now how many wonderful learning experiences would have been missed if there were only inefficient pencil sharpeners or if the teacher kept them on a high shelf?

You may ask, why not let every child have his personal pencil sharpener in his own pencil case? This is possible, but then you lose many important benefits of the Montessori method. The children do not learn the social co-operation involved in having only one of each thing. They are less free to move about from activity to activity, they have to bring their personal pencil case with them wherever they go. And finally, children develop a sense of possession about objects, which is unnecessary, we only need objects to use for as long as we need them. If you allow strong 'that is mine' principles to develop within a Montessori class you are encouraging one of the problems of society, 'possessiveness'. Neither ownership nor 'taking turns' play a part in a Montessori classroom. The rule is that the child uses something for as long as he needs to and then returns it to its place so that the next child can then use it for as long as he needs to.

4.3 Child Oriented

It is obvious that the environment must be prepared for the child or the adolescent in size. This is especially important in pre-school. The world of the adult is not prepared for the child. Most homes are not prepared for the child. This situation has improved greatly since Dr. Montessori's day and today most parents and almost all pre-schools have furniture and fittings that are child-sized. Most of our everyday activities have been designed by adults, for adults. We have to reassess them, redesign them and then present them to the children. For adolescents and older children, it takes greater creativity on the part of the teacher to see how to adapt to their needs. Ask them to help you design your environment.

4.4 Beauty, Order & Simplicity

Beauty promotes concentration. Dr. Montessori makes the point that churches or places of meditation are beautiful, whether they are elaborate or not. Why do we not offer the same to children? So often we say that schools must be utilitarian, easy to maintain, and easy to clean. However, beauty is essential if we want the children to be happy and to

concentrate. They have a sense of beauty, just as we have. If we do not offer them beauty they will lose this sense.

Order is also essential in the prepared environment. Order is an important part of beauty for humans. Having many things, many sensations and everything mixed up confuses our sense of beauty and pleasure. Order is also important in the environment because it is essential to the freedom of the child. If that pencil sharpener is not kept in its usual place, the next child cannot find it and the system breaks down.

A classroom should have many, varied, materials needed for development. This includes materials and other activities that the teacher thinks the children or adolescents might now or will need shortly.–The teacher should be ready to provide new activities or ideas as required.

4.5 *Control of Error*

Control of error is a basic principle built into all Montessori materials. We try to build it into all teacher made materials. You can also build it into the environment in other ways. There can be controls built into the furniture, for example, if it is light coloured it will show the dirt. There can be controls built into the way the room is laid out. If you put one chair and table in a corner it can become a quiet corner where a child can work alone. If the children are running around the room, re-think the layout to prevent this, rather than constantly correcting.

The use of floor mats defines the area where a child is working. This is a control. If another child walks on the mat, he will feel it under his feet. We can provide large working mats for work on the floor.

Teachers need to observe and to use their creativity to discover the best ways to build in controls into the materials and the environment.

4.6 *Freedom & Discipline*

Freedom is the basic right of everyone in a Montessori environment. However, there are limits to this freedom and it is from freely interacting within these limits that the child or adolescent develops self-discipline.

Freedom must be built into everything in the environment. You should lay out the room (or the outdoor area) with this in mind. Just as the newborn baby's environment must give the freedom for the baby to move her little limbs, the 12-year-olds' environment must also

allow enough space for him to stretch and move those elongated limbs as he works throughout the day. The adolescent needs the freedom to take control of his own work without referring to teachers and needs to have access to everything needed.

When designing the environment, consider limits to freedom. The control of error is often the same thing as the limit to freedom, as in the example of the floor mat given above. Limits to freedom may be in the size of the room. If the room is too large the children may find it just too difficult to control their movements and they will be tempted to run. This should also be remembered when preparing an outdoor environment. Large open spaces are fun, but children also require a purpose to their free activity and will like to play games involving limits. For example, games where a ball is thrown or kicked into a very limited space are types of games people of all ages enjoy.

Ways to prepare the environment in any school:

- Allow the children to give their opinion about how the classroom should be set up. This can even be a lesson in democracy – children may submit proposals for floor plans and the class can vote!
- Avoid standard layouts of rows of tables facing the front of the room, focussing only on sitting to watch the teacher speak. Instead, use group tables and space for working on the floor.
- Ensure there are work spaces where children can feel somewhat isolated if they need to concentrate in peace.
- Allow as much movement as possible. Sitting in the same position all day is not optimal for concentration and learning.
- Learning materials should be available, within reach, for the children, whether it be a book, art materials, or didactic materials, etc.

5. Concentration & Independence

Concentration is the central part of what a Montessori school tries to offer children. The ability to concentrate is at the core of character development and is more important than anything else we can offer in education.

Dr. Montessori believed the ability to concentrate was the most important thing for a child to learn. All other skills will be easier to learn when he can concentrate. It is many times easier for a child to study and learn when he is able to concentrate. The social development of the child, independence, self-discipline and the development of the will are all dependent, to some extent, on the ability to concentrate. A child who concentrates becomes a sociable focused person.

Concentration is built up by practice. Children need activities to practice concentrating on and the freedom to choose these activities. Spontaneous choices, which must be free choices, made by a child ensure that he is happy with what he is doing and therefore will give his full energy to it. Then he learns to concentrate. Concentration is about the whole person being involved in an activity, it involves a co-ordination of mind, body and emotions.

The adult plays an important role in the child's development of independence. This role is mainly about non-interference, not stopping the child from carrying out his natural urges to become independent. There are many positive things the adult must do to allow this to happen.

- First, the adult should set up an environment which encourages independence, making use of the control of error where possible.
- Next, the adult must observe the children and learn when they are ready for more independence and responsibility.
- Finally, the adult must examine himself and his own attitudes. This is probably the most difficult and yet the most important role of the adult. The adult's in-built attitudes are the biggest obstacles to the child's natural progress to independence and learning. These attitudes do not mean the adult is a 'bad' teacher or parent, but rather the adult grew up in a culture where freedom was not truly understood. Each of us inherited attitudes from the previous generation, but it is our task to examine these attitudes and decide if they are helpful in our roles as educators.

Another role the adult has is to help the child who has already been influenced by society, parents or another school, and is now unable to be free. The child who is afraid to make free choices will need encouragement to start acting independently.

6. Montessori Resources and Materials

Dr. Montessori designed a wide range of didactic materials all with the same purpose - to help the child to develop and learn independently. Montessori materials are designed very carefully to answer the needs of a curriculum based on cosmic education. They are designed to inspire children therefore they are exciting and beautifully presented. They provoke independent activity because they have inbuilt controls. They are orderly and encourage the discovery of the relationship between things.

Science, in particular biology, is presented by means of standard classification systems. Children identify characteristics of animals as early as pre-school and work in more and more detail over the following years, gradually building towards an exciting overview of the entire living universe. Children experiment in all areas of science, thus developing habits of observation, record keeping and curiosity.

In a Montessori class you will find many materials and books to inspire language creativity covering a wide range of topics. Language is about everything in the cosmos, and not exclusively about literature, according to Dr. Montessori. You will also find many attractive and colourful grammar exercises to encourage classification of language.

There is a very wide range of mathematical exercises, using concrete attractive materials. Observers are sometimes puzzled at the need for so many ways to teach a few mathematical principles. But the mathematics materials inspire more than mathematical calculation. They encourage the child to think logically, comparing things and ideas. Mathematics is also integrated completely into cosmic education. Dr. Montessori discusses this in the chapter on water in her book *To Educate the Human Potential*, published in 1947.

There are Montessori materials to support all the exciting ideas presented about the cosmos in history and geography. Colours are used to put classification systems in place for these topics. Countries are grouped, eras in history are coded by colour on timelines and so on. In the same way great artists and great musicians are presented on timelines, grouped according to style. Yet at no time do we allow this classification to dominate. The

inspiring story about the whole or about some detail is still the centre of our presentation. Classification is there as the support, the framework.

6.1 *Characteristics of Montessori Materials*

The materials must have certain characteristics. These characteristics are particularly noticeable in sensorial education but apply to all Montessori materials for all age groups, including hand-made materials.

1. *Limitation*: There should be a limit to the materials. There should never be more than one of each material. Children must learn to wait and to co-operate. Limits generally encourage the children to focus and give attention to the task in hand. In this way concentration is built up.
2. *Isolation*: We should teach only one thing at a time with the materials. It is distracting to present too many things together. It is also good to isolate concepts in order to encourage concentration on a particular thing.
3. *Attraction*: Material must attract the child. It should be beautiful, aesthetically pleasing and should be placed where it can be seen easily. It should call to the child, begging to be used. The teacher should not force the child to use it but leave it to his 'spontaneous choice'. Remember that spontaneous choice is the way in which the child can answer his true inner needs. The child should be attracted to the materials as the butterfly is to the flower.
4. *Order*: Material should be orderly. The order in the material should act as a focus for the activity. The smooth running of the classroom will also depend on orderly materials that are kept orderly by the children and by the teacher. Order in a material is often seen in the pairing or grading activity that is part of the activity.

5. *Activity*: The material must provoke activity. It must be possible to do things with it. In fact it must cry out to be used. There should be something that can be moved, or changed. Activity is the best way to learn anything. It encourages exploration and discovery.

6. *Control of Error*: All Montessori materials should include a control of error. The control is quite clear in some materials. For example, the last cylinder will simply not fit in the last hole if a mistake has been made. In some instances the control may be visual. As the children get older we can start to use master controls, cards, which have correct answers on them. Children refer to these to check their own work. The control of error is a point of interest in the exercise. The lack of adult interference is important because this is the process that builds up concentration and independent learning. The child will also see her own changing abilities with no outer humiliation, promoting self-esteem and security.

How can this be applied, on a practical level, in a non-Montessori school?

Within this guidebook, you will find samples of materials that can be used across a full curriculum. While mainstream schools and teachers may not have traditional Montessori materials or training for use of these, many materials can be created with little effort. By incorporating the characteristics listed above, you can create a wide variety of inspiring activities.

6.2 *Activities and Further Learning*

The presentations and inspiration form the first stage of the learning, “three-period lesson”. Then the children start to work with the materials themselves. But this second period needs more than just materials to work with. There is a need for other resources to help the child to internalise the ideas.

A Montessori classroom will have many activities to support the child's learning, for example creative activities, including painting, crafts, music, drama, creative writing, games, scientific experiments and so on. The environment includes the resources to carry out these activities. An important element of these additional activities is how they can be related to the central themes being followed by the child. If children are studying geography they can use a simple chemical experiment to make a simulated volcano or they may take a field trip to study local geology. When studying early human history they may build a model cave and stone implements or they may experiment on ways to make fire. When studying biology, they can paint butterflies or research classification on the internet. When studying grammar, they can invent drama games playing with words or perhaps they will direct their own plays. The list of possibilities is endless, limited only by the teacher's ability to prepare the necessary resources. A good teacher will involve the children in finding the resources to follow through on activities. Then the teacher's task becomes manageable!

6-9-year-old children have not yet learned all the skills of research. They need to be able to refer to attractive books for their information when they are younger and have not yet learned good research skills. Later they will need encyclopaedias and the internet. They will need access to a library and a telephone for the research they carry out. Going out will be an important part of research too.

6.3 *Transferable Skills*

At the second stage of learning the children need skills of research and project preparation. When the children reach the third stage of the three-period lesson they present their knowledge to the world and this requires a different set of skills, presentation skills. Research skills and presentation skills are by-products of learning about the universe in cosmic education. However, these skills are transferable skills, meaning they can be used again for other learning or other work later in life. They are an essential part of education and they are learned naturally when we use cosmic education or a similar project-based system.

To make something ready for an audience the children need to refine their research skills and develop presentation skills. Refined research skills will include knowing where to look for information, knowing what to look for and know how to edit and use that information when it is found.

It is important for teachers to focus on presenting practical skills to children in the early years of elementary school. As children progress, they will bring their skills to a more sophisticated and abstract level.

As the teacher, you should present all skills in a variety of ways. Firstly, you should model the skills. You should model how to undertake research, showing the children exactly and precisely what you are doing. You can also demonstrate various presentation methods, showing in a precise manner how to use different media.

Provide a step-by-step series of activities so that children can work gradually towards independence, practising their skills at each stage. For example, in the beginning you may have research books actually on the shelf beside the relevant Montessori materials. Later you can introduce the child to a reference list. This would be a list of the places where information could be found on specific topics, showing the child how to access this, be it on the internet or in the encyclopaedia. The child will eventually become confident enough to know where to look for information without any guides. Children will give up if a task is too difficult, so it is important to provide these little steps.

7. Cosmic Education - A Methodology

The Montessori method for 6-12 years is based on using the exploding imagination as a door to allow child to access large amounts of knowledge about the universe. In a Montessori school all subjects are inter-connected, and one inspiration leads to another. The teacher guides the children so that they learn the essential skills they will need and then presents many inspiring stories that lead to the study of anything and everything. This is the curriculum without limits!

7.1 *What Is Cosmic Education?*

Cosmic education is a method devised by Dr. Montessori to use as the chief means of education in the period 6-12 years. It was a way of presenting the cosmic plan to children and allowing them to learn about the universe in an integrated way.

Froebel first coined the term 'cosmic education' when he wanted to describe the unity of our knowledge and its interrelated nature. Dr. Montessori believed that an understanding of the cosmic plan was essential to all people and she also noted that the child aged 6-12 is ideally suited to this kind of learning. She used cosmic education as a basis for her plan for educating adolescents but in a slightly different way. She even suggested we use a cosmic approach within a sensorial framework for the preschool children.

7.2 *Wider Horizons for the Child*

In the chapter entitled "The Six-Year-Old Confronted with the Cosmic Plan" from her book "To Educate the Human Potential" Montessori talks about the child's consciousness being expanded outwards leading to her need to know the reason for things. These titles explain the core of the Montessori philosophy for the 6-12-year-old. You can almost see the 6-year-old coming over the top of a mountain and being confronted by this huge cosmos. In this 6-year-old child is great 'human potential'. Cosmic education aims to educate that potential.

The 6-year-old is opening doors at all levels. She is growing strong physically, her view of the world socially is now focused outwards on the group, her interests have suddenly expanded to include just about anything that is exciting, and her cognitive abilities have

moved into a level of analysis and abstraction. Her horizons have indeed widened. She is ready for learning about the world in the wider sense and cosmic education is the ideal tool for that.

When a child passes the age of twelve years and enters adolescence the focus narrows again to the self as emotional changes take place. However, at this time the young person gains an interest in how the world functions and what is his role in it. Both age groups (6-12 years and adolescents) should be inspired by the wonder of the cosmos and both age groups need to find their own role within the vast cosmos. But the driving motivation to learn is not the same and teachers should clearly identify the difference in focus. *The 6-12-year-old is excited and driven to learn by the wonder of the cosmos; the adolescent is excited and drawn by the need to establish his place within this wonderful cosmos.*

7.3 *Presenting the Whole and the Detail*

Dr. Montessori stressed the necessity of presenting the whole image of the universe. She believed that presenting disjointed facts to be memorised destroyed the natural interest of the child. She explains that everything, big or small, is not possible to explain without knowing about the whole universe.

However, she did believe that a presentation of the whole would lead to the study of details. Then the details would have more relevance to the child's interest. In turn, the details may be the inspiration to go back to the vision of the whole, leading in another direction this time. The connection between the whole universe and the detail within it is essential to cosmic education.

Dr. Mario Montessori Jr., the grandson of Dr. Maria Montessori, explains it well.

"One of the most fascinating characteristics of Maria Montessori was her ability to connect life at the moment with life in the distant past. A simple task would start her sketching a panoramic vision of man's evolution up to the present time, irresistibly stimulating the imagination of her listeners. ... The way she could talk about things like potatoes brought one immediately to a higher level of thinking and view of reality, while, at the same time, one remained immersed in human life. It was a unique experience."
(Montessori, Mario Jr, *Education for Human Development*, 1977)

7.4 *Relationship of All Things - Integrated Learning*

Teaching all subjects together is a concept that is difficult for most educationalists to understand. Even Montessori teacher training courses divide the curriculum into subjects. However, in the ideal cosmic education we would allow subjects to flow naturally into each other. Learning is integrated

Dr. Montessori wanted us to use cosmic education as the means of conveying all knowledge. She stressed again and again the unity of all things and saw no sense in confining children to 'a subject'. Children learn more when they are enthusiastic, and they will take in much knowledge. So we inspire interest in one aspect of the cosmos and this leads to a variety of learning. They will develop a sense of the unity of all things *before* they place everything into mental boxes. Then, not only do they become knowledgeable but they also become wise! They will understand the very nature of the cosmos.

7.5 *Developing a Sense of Wonder – Inspiration & Guidance*

To start this wonderful process of education the teacher presents the cosmos with stories of inspiration. The "teacher can no longer defend himself behind a syllabus and timetable" (Montessori, M., *To Educate the Human Potential*, Chapter - The Six-Year-Old Confronted with the Cosmic Plan, 1973). The teacher must prepare himself to satisfy the needs of this knowledge-hungry child.

Inspiration is the secret of encouraging independent learning. We must inspire the children with this vision of the whole, with the reasons behind things, with the exciting things to be found in the universe. Then the child will become enthusiastic and want to learn for himself. "There is a difference between such enthusiasm and mere understanding" (Montessori, M., *To Educate the Human Potential*, Chapter - The Six-Year-Old Confronted with the Cosmic Plan, 1973)

The child's imagination is the driving force behind learning in the period 6-12 years. If we present something and the child's imagination is not touched, it will not be possible to inspire her to work with it. We will be back to the old method of forced learning. Therefore, inspiring imagination and creating a sense of awe and wonder is an all-important key to cosmic education. Montessori speaks with passion about seeing "the child's intelligence as

a fertile field in which seeds may be sown, to grow under the heat of flaming imagination." (Montessori, M., *To Educate the Human Potential*, Chapter - The Right Use of Imagination, 1973)

7.6 *The Great Stories*

Imagination, according to Montessori, is the secret of human originality. It is your task as a teacher to enthuse this imagination. You must sow seeds of interest that will stimulate the child for the rest of her life and will be ready to grow whenever something relevant comes to her attention at any time. It is important that you create a sense of wonder, a sense of awe. This is much more important than the facts. The facts will only be partially retained regardless of the method used to teach children. It is more important to retain a sense of wonder that will guide the child back to seek the information for herself later.

In this instance "later germination" may refer to next week, next year or even in adulthood. We never know when an inspiration will lead to a personal interest for a child.

Inspiration is essential to make cosmic education effective. How do we inspire children? In her book *To Educate the Human Potential*, Dr. Montessori offers stories that we should inspire children with.

The Great Stories are five stories of the universe, which have been identified by Montessorians as being the main themes of what Dr. Montessori offered as good examples of inspiration for children. The five stories are about the evolution of life on earth, the evolution of humans, the evolution of civilisation and the evolution of written language and number. It is suggested that the children should hear these dramatic stories in the first few months of their years in elementary school. This will be the basis of much inspiration for research and work over the next six years.

However, it is most important to realise that these are not the only stories to be told. These are central themes, but a teacher can present a wonderful story around any number of themes. The themes chosen should relate to some awe-inspiring aspect of the cosmos. The themes may range from the galaxies, to strange plants in faraway places, to stories of cave dwellers. Montessori even tells us to use myths and fairy tales as long as they

support the truth of the universe. The essential thing for the story is that it follows a few basic principles as follows:

- The story must be inspiring and exciting.
- It must start with what Dr. Montessori called 'philosophical lofty notions' of the cosmos - these are the philosophical notions behind the cosmic plan.
- This philosophical approach must be presented in language that appeals to the children, related to their interests at this age.
- It must include sufficient and correct information to ground these lofty notions in reality, but it is not essential to give *all* the facts. Leave space for the pupils to do research themselves.
- It must show how things and events in the cosmos are interrelated, and especially related to the child's own life.
- It should indicate the means by which the child can continue researching this information.

See the activities section of this manual for examples of cosmic stories.

7.7 *Spontaneous Activity*

Spontaneous activity is where a child chooses to do an activity because of an inner drive, a *finalistic* force, rather than because of external pressure, a *causalistic* force. If the child chooses an action that matches an inner need, then she will learn with far greater energy. There is really no comparison in the level of learning that takes place. Forced learning may be retained in the memory for a time but will eventually fade away. All learning must have some meaning to the learner. When a child is prompted from an inner force to do something, it is obviously of meaning to him.

For the pre-school child spontaneous activity is usually driven by the *horme* or later the will, guided by the sensitive periods. For the school child the inner drive will come from the imagination. Children who want to learn will take in more knowledge!

In practice this is not so easy to carry out. The teacher finds it difficult to let go of complete control. However, in general the more freedom a child has, the better will she learn. Work

plans are plans of what work a child should do for a chosen period. However they are set up, work plans have limited use in a Montessori school. They inhibit spontaneous activity! And therefore they stop the child's learning being driven by the flame of his imagination.

Occasionally new Montessori teachers need to use plans until they feel confident, or occasionally children who have come to Montessori freedom at a later age may need the structure of plans until they become used to making their own choices. As a teacher becomes more experienced she should give more and more freedom to the children. She should trust their imagination and trust them. She can focus on inspiring lessons, on preparing an exciting environment and on observing to see how and why the children work. It is essential that Montessori teachers give much energy to ground rules of behaviour at the beginning of the school year. The children gain the feeling that they are in charge of their own lives and spontaneous enthusiastic learning flows naturally. Ideally this level of self-controlled behaviour should have been laid down in pre-school, but teachers should also re-inspire this attitude regularly.

As the child reaches the more advanced class you, as the teacher, will have to manage a much larger curriculum. You may ask how you can sit back and depend on inspiration. Remember that the pupils will learn more when inspired. So do not bore them with too many "facts" just because they are on the curriculum. Instead select the most inspiring facts and when they are interested in the topic they will be more interested in learning the details.

How can this be applied, on a practical level, in a non-Montessori school?

A teacher knows what is coming up in the curriculum and knows what assignments a student might be required to do. Teachers should prepare children by teaching them how to do their own research, then present inspiring stories which will connect children to the themes in the curriculum. Whenever possible, allow children to discover facts for themselves!

7.8 A New Kind of Lesson

Within this cosmic education the child is learning by a kind of three-period lesson. What is a “three-period lesson”? This lesson was first given by Dr. Montessori as a method for learning vocabulary. It identifies the three stages of learning. It is the means by which babies take in language and learn to talk. It is the means by which we all study and learn.

Put very simply, the three stages of a Montessori three-period lesson are:

1. Adult gives information (such as the name of a dinosaur) - child takes the information in.
2. Child identifies but cannot name yet - information is processed by child.
3. Child gives back information.

To make this more concrete, the three-period lesson for cosmic education (for older children) is:

1. **The first period:** The teacher inspires, telling wonderful stories, demonstrating exciting or challenging materials, activities and reference resources. Children can ask questions and clarify the facts. As the teacher, you should ensure that the children understand where and how to find the resources. This is a sensitive time because you will need to note if one child does not fully understand. The force at work in the child at this point is a *causalistic* force. It is external, the inspiration is coming from you, the teacher.
2. **The second period:** The children are working with this story, material and information. Now the force at work is *finalistic*. They work because of an inner need that has been inspired into action. They research work in groups or alone. They design projects or just simple posters. They write stories. They invent new mathematical calculations to challenge themselves. The length of this period will depend on the particular lesson - from half an hour to several weeks. Other activities will probably be going on at the same time. But they may decide to work only on this project! If children want to work exclusively on one thing for weeks at a time, it is a very good sign of enthusiasm and concentration.

3. **The third period:** The children give the work back. They present to the class, to the teacher or they use their knowledge to go further in their learning. They use it to manifest themselves in the world. They have made it their own. At this point they are combining finalistic and causalistic forces. They are presenting because they feel an internal need to do it, but external feedback from the outside world will adjust and modify their thinking and ideas, preparing them to move to the next phase.

How can this be applied, on a practical level, in a non-Montessori school?

With integrated project-based learning:

1. The children are introduced to a topic
2. The children go out and discover more (internalise information)
3. The children return to share their findings with the group.

This sequence applies to any and all subjects. It is about inspiring and empowering children to discover!

7.9 *Classification*

Classification is any system used to group things or knowledge into categories according to characteristics. It brings order to large amounts of knowledge, making it easier for us to access that knowledge. Classification is central to cosmic education.

The knowledge of the universe to be offered to children is so vast that there needs to be a system of order put on it to make it accessible. Children classify and compare in every subject - science, mathematics, language, history, geography and so on. The principle of creating order in the intellect with sensorial education which Dr Montessori designed for pre-school, is followed up at elementary school and upper school levels with systems of classification for all knowledge. Apart from the need to put the vast amount of knowledge in some order, she believed that the notion of comparing and classifying was the secret of education. Facts have little meaning to the human mind unless they form part of a whole picture. This brings us back again to the unity of the cosmos!

Dr Montessori insisted that education was about showing the relationship between things. She kept referring to the connection between the whole and the detail. Classification provides the structure to do this. We present the whole first and then the detail in our inspiring stories. But classification provides a means of presenting the details and building back towards the whole. For example, the child may study the characteristics of individual animals (detail), then classify them according to these characteristics and eventually create an overall picture or pattern of how life evolved (whole).

8. Going Out – a Curriculum

'Going out' is one of the child's basic needs, according to Dr. Montessori. It is very important in relation to cosmic education. The meaning of "going out" in a Montessori setting is any activity that takes the children out of the normal routine and physically out of the building, exploring nature or culture in their locality or further away. This "going out" also includes much preparation and the children must be involved at every step of the preparation. It is an essential part of the learning process.

Inspiration comes from 'going out'. Children will be enthused when they can see the real thing. It will impress them at a level not to be found in books. Real life is more exciting than a book, or even a screen!

In the second period of their cosmic learning, activities and research will be enhanced by going out. Children can organise outings themselves to find the information they need. The teacher will help by offering guidance. Maybe it is an outing to a museum or to the forest or to a concert. It will be a source of activity and research for the pupil, bringing the exciting information and the real-life experience into his own reality. Montessori stresses the need for the child, at every stage of life, to plan and carry out activities by himself, so that he maintains a balance between action and thought.

'Going out' and real work will again have relevance to the child in the third period of her learning. When she has internalised the knowledge and is ready to pass it on in the form of a presentation she can go out into the wider world. She may only go out into the corridor to display her project, she may present her findings to the class next door or she may even visit the local community centre and present her project. Or, as commonly happens in a Montessori class, she may tell a younger child all about what she has done, inspiring him to follow up on this theme too. Then again, she may just take her knowledge with her to the library and search for further inspiration for the next stage in her learning.

Going out can also include going out in an abstract sense. The child may just want to go out into the cosmos through videos, the Internet, books, stories, materials and so on. We as teachers can make this available, ensuring that our notions of what is possible do not impose limits on the exploding imagination of the child. We must however, relate cosmic

education to the deep need for real experience. Therefore, no cosmic education project should take place entirely within books.

How can this be applied, on a practical level, in a non-Montessori school?

When possible, allow children go outside the classroom to enhance their learning with real-world situations and resources that are relevant to their interests and current studies. Visits to museums or even local businesses can make it easier for them to relate knowledge to reality. Let the students be as involved as possible in every stage of planning for outings.

9. Cosmic Education and Moral/Social Development

Dr. Montessori pointed out that cosmic education provided an ideal support to the moral and social development of the child 6-12 years.

In the 6-12 years stage of heightened moral awareness, stories of grandeur in the universe, of heroes and heroines, will excite and provide models and ideals for the children. Their sense of responsibility for the universe will be fed with an understanding of the balance and interrelatedness of all things in the cosmos. These are the basis of a moral code. The children will learn about this even before they learn or remember facts. This is because cosmic education focuses on 'lofty philosophical notions' in a manner suited to the psychology of the child.

Socially the child is learning about being a group member in the years 6-12. The nature of cosmic education is about interdependence, cooperation and balance. This is ideal for learning a social code of 'give and take'. It also gives a sense of one's particular importance within the whole scheme of the cosmos. In addition, the work the children carry out involves group co-operation and interaction, in and out of the classroom. In addition, cosmic education aims to give the child a sense of awe and respect for life and the world about him, and this is indeed the basis for social education.

9.1 *Cosmic Curriculum - an Approach or a Syllabus?*

Cosmic education is the basis of the Montessori curriculum. Together with independent learning, cosmic education can be seen as the guiding principle of the curriculum in the years 6-12. When educators refer to curriculum they mean underlying themes and pedagogical principles that drive the syllabus. The syllabus is the detail of what is actually taught.

Cosmic education does not include a precise syllabus. It is an approach to education, a pedagogical principle. In fact it is much wider than a pedagogical principle. It is an overall approach to life and the universe. But for the purposes of the classroom we can see it as the basis of the curriculum.

Having identified the themes that drive the curriculum, the cosmic approach and independent learning, the teacher then designs a syllabus. The Montessori method offers a detailed range of activities that can provide the basis for the syllabus. This includes particular materials, stories and activities that will make up a large part of the necessary syllabus.

In practice, few Montessori schools manage to cover all the activities from the Montessori “syllabus” for 9-12 years. Teachers should be familiar with them all and present those of most interest to the children. It is important for teachers to learn how to design activities and make materials based on the same principles. Teachers present cosmic education largely through their own personally designed activities.

It is necessary to go beyond the basic Montessori materials to provide for cosmic education and teachers study a range of subjects to get the necessary knowledge. You do not have to use standard Montessori materials. You may have other ideas that can implement cosmic education. But the range of knowledge required is so vast that no teacher should ignore such a well-designed and rich resource as that provided within Montessori materials.

Independent working, including projects, enhances the self-esteem of the pupils and allows for practice in independent learning. These points are central to the Montessori approach. It is a basic Montessori rule that personality development must come first. Learning comes easily to a child who can concentrate and learn independently. Therefore, it makes complete sense to give attention to self-esteem, concentration and independence *before* focusing on the facts of the curriculum.

When the pupils are inspired, then and only then, can the teacher focus on the details of what is required in a curriculum. Inspire with a theme and then let the pupils use their imagination and skills to guide the project’s direction.

10. Culture, Creativity & Projects

10.1 *What is Culture?*

By *culture*, we mean all the ways, mannerisms and tastes of people. It is about how people do things and what they create. Every nation has its own customs and habits. For a young child, this is of particular relevance because this is the time when she is learning about her own culture – its language, customs and tastes.

- For the youngest children under 3 years, culture is to be found in the immediate environment. It comes from her home and the local places she is taken to. She starts to learn the body mannerisms, language and gestures of her culture.
- For the child of 3-6 years this will expand to include playmates and preschool. He will continue to absorb the ways of doing things in his culture. He likes to refine this and becomes particularly interested in courtesy customs. His interest in art and music is still at a sensorial level but as he becomes familiar with it, he learns to love his own culture and is laying the basis for a future understanding.
- For the child of 6-12 years culture is everything in the universe, but with particular emphasis on the things that relate to her and her life. She will be interested in art through history but will want to orientate herself as she looks for paintings that relate to her planet, her country, her lifestyle and her own tastes.
- For the adolescent, culture is about social customs that provide a place for him. He will seek out the music of his own day because it helps him to relate to others of his age, giving him an identity within society.

Mixed cultures present a learning and growth opportunity to all concerned. Children who are coming from one culture to another need sensitivity and support, to allow them to find an interest and comfort in their “new” culture, while remaining connected to and proud of their original heritage. While children are learning about the new culture they have entered, show them the respect of learning something about their culture, too. Exchange of knowledge of cultures, both for indigenous and migrant people, promotes understanding and cooperation.

10.2 *Creativity & Reality*

What is Creativity?

Imagination is a power of the mind. It is the power that allows humans to go beyond the confines of their physical form and to be part of a wider world. It is the power that leads humans to create new ideas and new ways of living. Creativity is the ability to take known facts and create something original from that. Creativity is the flow that makes being human exciting. Imagination is a power that leads to creativity. Ideas are abstracted and then converted into reality again. The creative mind should not be seen as the opposite to the logical mind, rather it is a partner. Imagination is the power behind these two parts of the mind, logic and creativity. Intelligence might be seen as the overall container.

Reality as a Basis for Creativity

When the child's imagination has been inspired by reality, he will be creative. Take a boy writing a story about the woolly mammoth. He has a pet dog, he has seen sheep roaming on a mountain, he has seen pictures of ancient mammoths. He can create an image of a world where mammoths roam. He puts them together and imagines an exciting fantasy that one of the boys in the cave has a pet woolly mammoth.

All the facts were based on reality but with the power of imagination he created an interesting fantasy story. He is in touch with reality and distinguishes between what is fantasy and what is reality. If he is fed too many fantasy facts - that are the product of somebody else's imagination - he will lose the ability to stay in touch with the real world. His own creation will then not inspire him to return to reality for more facts, rather his mind will wander in the world of fantasy. He will miss out on the inspiration provided by the wonders of the world.

The Creative Arts and Cultural Expansion

The creative arts can be loosely defined here as art, crafts, music, drama and creative writing. They form a large part of cosmic education and the child's overall cultural education. Children learn about the history of art, and the lives of artists. They may learn how dramas were presented in Shakespeare's time or how the Stone Age people painted their caves.

Their cultural expansion may take the form of trips to the art gallery, to a concert or a play. There is a vast array of exhibitions in cities and towns and children should be encouraged to get involved in choosing what to visit and planning how to go. Use books or digital resources, to allow children to access vast amounts of culture. As for any subjects, you may need to supervise and decide where to set limits with online research. You must decide on the limits necessary and control the overall environment and what is in it. It is important that you do not interfere with children's enthusiasm. Instead, you should observe and make decisions about the best overall plan for the children's education, remembering the principles of independence, freedom and cosmic education.

10.3 *Culture & Creativity in Action - Activity & Freedom*

Activity in Cultural Exercises

Cultural exercises should involve activity. Many Montessori teachers make the mistake of presenting wonderfully exciting lessons but with no follow up independent activities for the children. The children need activities to help them to absorb the information that went with the inspiring presentation. These activities may take the form of projects, but they may also take the form of matching puzzle exercises, for example placing the correct names on the countries of a continent.

Children may also design their own activities. They may want to follow through on a particular aspect of the subject and to make something or do some special research. You should observe them as they do this type of individual work. Occasionally children who cannot concentrate and who wander aimlessly in their work will use such activities as an escape route to continue their wanderings. In that case you need to guide them back to more limited activities until they show signs of being able to direct their own work in a constructive manner.

Activity and Freedom in Creative Expression

Inspired through their imaginations to work with certain topics, older children create ideas and feel the need to externalise these ideas into a product - be it a story, a poem, a painting, a performance of music or drama or whatever they want to do. The task of the

teacher is to provide the children with the means to learn the necessary skills to create; then the teacher must provide the inspiration, or the routes to inspiration, for creativity.

Freedom of choice and freedom of expression will obviously be important if we are serious about creativity. Teachers always have to define a line between inspiration and doing the job for the children. Keep trying to remember to offer skills and to inspire - then stand back.

As with all freedoms in the Montessori classroom, you need to create an atmosphere of freedom. This will be built into the way the room is laid out, the way you address the children, the rules of the classroom, the schedule of the day and so on. Freedom cannot be something you just bring in for art class or just for the afternoons. Children restricted will not have experience of freedom and will neglect to take the responsibilities that go with freedom.

It is important that the teacher is observant and sensitive on this issue. Children who have not learned to control themselves and to work in a focused way should not be allowed to use free activity as an escape route to continue their aimless wanderings. The teacher must offer limits in the form of set activities until the child suggests a constructive alternative of his own choosing. But observation of the child is a key point here. The child may be ready to take over at any time and the teacher must be sensitive enough to pick that up and withdraw at the right moment.

10.4 Preparing the Environment for Creative Arts

The preparation of the environment is a key element in the presentation of any subjects in a Montessori classroom and the creative arts are no exception. The environment must be prepared to provide for the inspiration, freedom and structure as mentioned previously.

To provide for inspiration there should be exciting and beautifully prepared materials on a wide range of subjects. These materials should be laid in a place where the child can see them and is therefore inspired to work with them.

The freedom required can be supported by making the materials self-correcting, by laying out the room so the children have the space to work with them and by controlling the

timetable so that the children have a work-cycle that allows them to work independently for reasonable periods of time.

Finally, the structures that protect that freedom are important. In addition, these structures are part of the grounding needed by the imagination. They will include means by which the children can organise outings, a telephone for example, and means by which the classroom can be organised by the children in order to work together or alone on projects. For example, arrange for meetings between teachers and children to discuss organization of work. The teacher must maintain contact with reality when working with creative subjects. Routes to accessing real information or real experiences are an essential part of the framework for encouraging creativity. Research resources and outings will be the practical means of making this work.

10.5 Skills to Support Creativity

For the younger child, painting is taught as a practical life activity - how to hold the brush and how to keep the table clean - and the everyday environment offers inspiration for the painting. He is not yet ready to be truly creative. He is forming the tools for creativity. A deep interest in creativity will come at 6 years and he needs to be ready for that.

Children in the 6-9 years stage should be laying down all the basic skills of writing, painting, drawing, playing music, and speech and drama techniques. In the 9+ years period the children should refine these skills to a more sophisticated level, but should be able to use them sufficiently well to work alone.

Skills should be presented in the classroom as part of the day's activities as far as possible. The classroom teacher should learn to present the basic levels of skills. An expert teacher may visit the class for certain periods to demonstrate particular things. When the children reach 9 or 10 years, the level of technique will be much more refined.

The presentation of skills should be presented as any other Montessori exercise. The child is asked to watch while you present clearly and in simple steps. Then you stand back and allow the child to try. When the skill has been acquired it is applied to creative work. For example, if you want a child to learn to sew a straight running stitch, demonstrate on a

sample of cloth, let the child practice on this and then later let him apply it to the making of a bag or whatever he chooses.

10.6 Creating Good Models

One of the ways in which you can inspire children is to create good models. This technique can also be used for teaching skills of creativity. For example, if you make a model of a Stone Age cave using papier maché and modelling clay you can then offer them the freedom to make something of their own. From your model they will learn how to relate a theme, Stone Age, to a creation, and they will learn how to use papier maché and modelling clay. They can watch you create some parts of this, but you should make some of it in your own time so that they are not bored watching. Children may also help you in the making of models, but you should not have it that way all the time. Do not let them use up all their enthusiasm in creating something that came from your ideas. Let your ideas be seeds that can germinate for them into something new.

10.7 Creative Arts and Holistic Development

You will realise by now that holistic development is central to the Montessori method. Most methods nowadays are holistic, but the Montessori method is very particular about applying it in practice. The creative arts are part of this holistic process.

When a child is playing a drum or painting a picture or writing a poem different parts of her are involved. She is working physically, and we should pay attention to that when we prepare her skills. She is working emotionally, because emotions are a driving force behind creativity. In fact, it is the inspiration of the imagination that is driving this creativity and that has an emotional base! As the teacher you take care of this when you inspire the child. The child is also working mentally as she plans her work. Once again, the imagination is part of it.

However, if the child is working in a way you had not planned - painting using her teeth to hold the brush or being inspired by some television programme that you disapprove of, you should take a step back and observe. Maybe this is how she can create her own holistic approach. Do not interfere unless you believe that this is unfocused activity. Dr.

Montessori suggested that we should look at the movements of the child when we want to know if the action is a 'spontaneous activity' or 'pure impulse'. Uncontrolled limbs usually indicate 'pure impulse' and you may put a stop to that. It is part of the task of the Montessori teacher to control unruly activity. But please do observe first.

11. An Interrelated Curriculum - Projects & Research

Projects play an important part in cosmic education in modern Montessori schools. They are particularly useful in the 9-12 years age group, because by that time the children have the skills to research and prepare work on their own. The 9-12-year-olds do more projects than the 6-9-year-olds.

Projects allow for combining subjects and seeing how they relate. They expose the child to many aspects of culture and they offer opportunities for creative expression. Projects are mainly designed to give children a means to continue learning about something, which has inspired them. Projects are wonderful tools to create new learning experiences based on a particular aspect of the child's interest. They continue to re-inspire.

Projects...

- provide opportunities for pupils to present the knowledge and skills they have acquired.
- keep the focus on what the pupil knows, rather than testing for what he does not know. This is important in promoting self-esteem and inclusion.
- create opportunities to learn social techniques by working in groups or by needing to approach others for help with research.
- provide opportunities for children to practice research techniques.
- provide opportunities for children to practice creative arts skills and put them into practical use.

11.1 *Children Doing Research*

It is essential that the Montessori environment includes research resources. Children between 6 and 12 years are greatly interested in researching. The skill of research can be compared to the control of error. It is a tool which keeps adults away from the child's work. It is therefore an important tool on the road to independence. What will give a child a greater sense of independence and good self-esteem than to have looked up and found the information he needed for himself?

6-9 years children must lay down many of the skills of research. The function of teachers for this age group is helping them to do this.

Research Skills! Children need to learn how to:

- Look up information in dictionaries and encyclopaedias.
- Use reference books and to borrow books from the library.
- Use technology and research responsibly on the Internet.
- Present work neatly so that they can present larger projects later.
- Perfect the skills of writing and drawing.
- Create small presentations using varied media.
- Practice presenting to an audience.

This type of work inspires study which fits with cosmic education. The child has acquired skills that will make him independent.

From 9-12 years is the 'age of research', according to Dr. Montessori. She claimed children were capable of more research in those years than at any other time in life. Later in life their minds become cluttered with other issues, emotional and financial and career related. In these special years the children have acquired mature skills of research but still have the driving passionate interest in information which characterises middle childhood.

Children should be encouraged to research and then to present the results of their research. At first, the presentations may be to the group but later it should be to the whole school and perhaps to visitors. Children will use their natural social skills to create group projects. It is wonderful to watch as they share out the work according to different wishes, cultures, and talents. Projects may also be individual. From this work the children learn organisational skills which are essential to independent learning and independent living.

The task of the teacher is to guide, particularly at the beginning and the end of the project. Teachers may also need to be on hand to point in the direction of research sources. It will also be necessary to offer encouragement in the middle stages when the project seems to have lost its direction and the children have lost their enthusiasm. The teacher should

encourage a high standard of presentation but should not undermine efforts made by the children. The main thing is to support the development of independent learning.

11.2 Interrelated Subjects

Projects that are based on cosmic education must be able to cross subject barriers. You know that subjects such as history, geography, mathematics and language must be interrelated. Likewise, you should allow creative arts subjects to flow into one another. Encourage the children to paint or write stories or sing songs for a project. Allow different creative mediums and different subjects to intermingle within the one project.

You should show models involving a range of creative mediums and a range of subjects. You should introduce the children to each of these. However, do not insist that children use particular mediums. As with other Montessori presentations, present well so that the child is aware of her options, then stand back and allow freedom of choice.

11.3 Inspiring & Guiding Projects

Inspiration for a project may come from a child, from the teacher or from some event, such as a visit to an interesting place.

A child may receive inspiration from a source other than the teacher and in that case the role of the teacher is to guide the children towards the information they need. You will also inspire projects through a series of presentations, such as time-lines. This type of project will involve many class materials and exercises. It may be a project that is ongoing over a long period of time. The child may return to it again and again, adding more as his research into civilisations expands.

You may also design projects around a particular theme. In this case you will do some research, make some materials and then present the theme to the class. The inspiration to make the children take part will come from the quality of your presentation and the attractiveness of the activities offered.

Inspiration for every type of project, big and small, must be based on appealing to the child's imagination with exciting wonders of the world, based on the reality of the world. Out of this will grow creativity – and the creation of some marvellous projects.

11.4 *The Teacher's Role*

Guidance for projects will vary depending on the nature of the project. Projects may be for individual children or for groups. They may be for a small group or for the whole group.

When it is a project inspired by something the child has discovered himself, listen to the child's plan, offer guidance in a respectful manner and help when asked. If the project is based on a series of presentations such as the time-line mentioned earlier, you should continue to make presentations of new and inspiring aspects of this material. The child will also require guidance on how to keep working on such a project over a long period of time. Teachers need to encourage children to have pride in the slow building up of long-term projects. Not everything has to be taken home within a week!

When the project is one you have planned around a particular theme, your role will be more active. You will guide the overall direction of the project, but the children will have choice in how particular aspects are carried out. You will be the key to a continuation of inspiration and the stimulus to keep going when activity has reached a boring phase.

11.5 *Freedom and Independence in Projects*

A key to offering freedom and independence:

If a child CAN do something themselves, let them do it themselves. Their skill, creativity, and self-esteem will grow.

By offering the kind of inspiration and guidance Montessori recommended, the teacher can offer children freedom and independence when working with projects. They are offered opportunities to build up their general knowledge, creative skills, learning abilities and general character development - all at the same time.

It is crucial that teachers understand the underlying principles involved when children are doing projects. Projects are useful tools to bring out and extend the learning inspired by cosmic education. However, they are not goals in themselves. Dr. Montessori believed that children had potential far greater than just following projects designed by teachers. A topic that stems from personal interest is more likely to hold interest and be remembered over a longer time period.

12. Creative Language and Language Skills

12.1 *Language as Part of Cosmic Education*

Dr. Montessori placed great emphasis on the importance of language as the tool of human social interaction. She stated that language was at the core of the way civilization transformed the environment.

Dr. Montessori's approach to language development for the child over 6 years was similar to her approach to other subjects. She believed creative language could not be taught. We have to offer the child the tools to create language - in this case, the skills of language. We must offer exposure and access to language as a source of the child's culture, in other words, surround them with good language, good books and other sources of inspiration. Then we can inspire creativity. Dr. Montessori and other educationalists carefully differentiate between literacy and culture, which includes creative language.

In a Montessori system, the child will often have mastered the basics of reading and writing by 6 years old. Dr. Montessori observed that 6 years was too late to teach reading and writing, because they can be learned sensorially through exploration. By 6 years, the child is ready to be inspired to create language and is now interested in analysing the grammar, syntax and structure of the language.

Observe children over 6 and notice how their confidence in using language increases, while their vocabulary gradually grows richer. Look at the speed with which adolescents learn text message “speak” for mobile phones - their ability to learn language is still alive!

One of the points that Dr. Montessori emphasised about language was the importance of relating it to other subjects. Language is learned through geography, history, mathematics and so on. Literature is part of an overall cultural programme that inspires language development and is also supported by language development.

Pertaining to the **SEDIN** project, where language has been identified as one of the main challenges, it is important to keep in mind the social mentality of the 6-12-year-old. As children work on different group projects, the support of their peers and the concrete materials will help their language skills to develop naturally, without the pressure of traditional formal language learning.

12.2 *Theories of Language Development*

Without exploring language theories in any depth, it is worth pointing out that many theorists see language as part of intellectual development. In other words, although concepts may exist anyway, they are hard to pin down without language. This ties in very closely with Dr. Montessori's three-period lesson. She offered children a sensorial 'alphabet of impressions' to help to put mental concepts about the environment in manageable order. She then gave labels to these (three-period lesson) to act as a prop or support to the mind in forming this order.

Language development in children is a full subject of study in itself, which many psychologists since Dr. Montessori's day have researched extensively. But note a few points about language development theories. One question that arises is that of whether we learn to read or read to learn? Another question is whether the intellect builds language or language builds the intellect? The stages of listening, understanding, and communicating have been identified by most language development researchers (*Child, D., Psychology and the Teacher, 1976*). This follows exactly Dr. Montessori's three-period lesson - the teacher names, the child identifies, the child names. The three-period lesson is also seen by Montessorians as the method by which infant/toddlers learn to talk.

12.3 *Refinement and Expansion of Language*

The period 6-12 years is one of refinement and expansion of language. Between 3 and 6 years the child has been refining and expanding vocabulary. But now between 6 and 12 years she is ready to move into a much richer level of language. The power of her imagination, the fact that she is exploring wider horizons and the power of her analytical mind all serve to develop a rich and useful language. Therefore the 6-12 years stage is

essential in refining and expanding language. We must support this in as many ways as possible.

Bring the children out, allowing them to expand their language everywhere they go. They must be exposed to rich language as they study other subjects. Language in itself must be a topic of interest, studying the history of language and other languages.

12.4 *Reading Development - Interpretative Reading*

Dr. Montessori believed that reading aloud was a very complicated operation. She wanted children to learn to write first. She developed the word building exercise and emphasised the development of the hand for writing. Then she said children should read silently for some time after they first learn to read. She believed that this phase needed much practice, giving time for fluency to develop. If children are asked to read aloud before they are ready they will lose the joy in reading. Reading should always be fun, not a chore!

Dr. Montessori utilised interpretative reading. This is an exercise where children read short phrases and act them out. By quietly observing the teacher can note if the child understands what he has read. These phrases can be simple grammar sentences such as commands: "Open the door!". A teacher should look up poems and books and choose interesting sentences to use as interpretative reading exercises. This satisfies a need for drama, is an independent exercise and is a wonderful way to learn to read!

This idea can be expanded to include interpretative reading of poems, short plays, short stories and so on as children get older. Children can work in groups, reading to each other while enjoying the drama of the activity. When they reach 10 or 11 years this activity can also include group assessment of books, plays or poems, as they read and act them out.

12.5 *Creative Language*

Children need to be inspired to write just as they are inspired to work with any subject. In the first place you need to create an atmosphere of writing. Encourage children to write about all sorts of things.

- Encourage children to read.
- Inspire by offering topics to write about.
- Offer models for the children to follow. For example, have short stories on simple topics in the classroom.
- Offer guidance for creative writing by having fun exercises with 'start sentences', for example "Write a story that begins with a deep dark forest." or "Write a story that includes three of these phrases...".
- As children get older, introduce genre writing. Present a list of genres to inspire children to write different kinds of stories.
- Encourage children to other forms of writing, such as poetry and plays. Children can write plays and then produce and organise a performance!

Never correct mistakes in grammar or spelling in a child's creative writing work. When children have learned the particular rules of grammar or spelling you may direct them to correct their own mistakes. Most creativity in writing is killed by correction!

12.6 *Children's Literature*

The choice of books for children is an important part of language teaching. Books should be inspiring, exciting and relevant to the child. It is important to have a choice so that choice for the child is real. Books should include modern literature and classical literature. Although you will choose books for the children to read, you must also provide books that the adult reads aloud for the children.

The language in the books should be slightly challenging to the child's reading and understanding ability. If it is too easy it becomes boring and if it is too difficult the child gives up on it. The subtle differences in the child's reading abilities are many. You need to provide a selection of books that will provide for each step on the ladder of reading ability. Experience and observation will help you in making this selection.

When older children are learning in a new language the teacher must be sensitive when providing reading material. Provide books that are both language AND age appropriate (i.e. do not give pre-school stories to a 9-year-old just because they match his language ability). Provide books in their mother language as well as in the new language. Increased proficiency in any language is beneficial to overall language learning.

Literature must be presented as an aspect of the child's own culture. It is an inspiring part of any culture and should be presented to the child as such. Not only will he gain a love of his own heritage and an appreciation of others, but he will be inspired to create his own personal literature.

12.7 *Writing Skills*

Spelling and Punctuation

The tools of creative written language are needed by a child if his creative products are to be understood by others. Spelling and punctuation should be learned in the years between 6 and 12. But it does not have to be the chore that it is often labelled as. Spelling and punctuation can be taught as skills in themselves using interesting exercises based on attractive Montessori materials. Ongoing practice with these activities develops the skills required for written language. These activities are usually designed for children of 6-9 years. If you have pupils who have passed the age for learning spelling and punctuation through these materials yet need help in this area, you can challenge yourself to apply the

An important principle for the teacher to remember when presenting spelling and punctuation skills is that they should be taught parallel to creative writing and the two should not be confused. Correction of spelling and punctuation will kill creativity for the child.

Montessori principles to invent an activity that will help them to help themselves!

It is a basic Montessori principle to isolate what is being taught. In this case we teach spelling and punctuation as a separate exercise, and do not try to teach it by correcting the spelling in the stories the child has written or other work they have done.

Later children will have learned most of the basic rules for punctuation and spelling. At this point they can start to self-correct but it should not be over-emphasised, rather it should be introduced gradually, waiting for the child to develop a spontaneous need to 'get it right'.

Grammar

Grammar exercises have a special place in the Montessori classroom. They have purposes much wider than the teaching of grammar. They develop the intellect, encourage analysis, create opportunities to concentrate on fun activities and help the child to deeply understand the function of words. The exercises designed by Dr. Montessori are colourful and attractive, orderly and fun to do.

There are some key points in grammar exercises. The materials involve activity that gives the child a sense of having the power to use language to her own purposes. The materials are colour coded and this allows the child to absorb the function of different parts of speech in a sensorial manner before she is able to understand the meaning behind the grammar. Colour is of particular relevance when a child is first introduced to grammar in a Montessori class that is between 5 and 7 years old.

The grammar exercises are orderly and involve the analytical mind of the child. This is central to the Montessori method of education for the 6-12 years age group. The material allows the child to compare parts of speech, to experiment with them and to be creative. This is much more interesting than a boring method of learning about grammar by rote.

You may also need to teach grammar to older children who have not covered these materials at the standard age. The Montessori materials for grammar are excellent for older children because they challenge the emerging sense of reason and logic. However, the method of presentation may be slightly different from that used for younger children. For these older children, use an approach of investigation and comparison with other grammar sources. For example: "Let us look at this chart which explains adverbial clauses.

We can try some sentences on this and then we can look at the grammar book and see if the rules fit with what we have done. Maybe we need to change the chart. Let us think about that and investigate it fully with some more examples!" We should remind ourselves again that Montessori said true education was not about quantity of knowledge, but rather it is about the relationships between things.

Other Writing Skills

Apart from creative writing, there are many different formats in which we write. We write reports, essays, biographies, factual accounts, diaries and letters - formal and informal. Each of these can be introduced to children as skills of written language.

The principles behind this teaching are based on the same principles of isolation and activity that you have seen in all Montessori exercises. You can offer models and exercises for the children to practice their own skills.

13. Classification

The human need for intellectual order was felt so strongly by Dr. Montessori that she built it into many activities in her method of education. To her, classification was an ideal means of keeping mental order and holding onto large amounts of knowledge.

The human tendency for order is in each of us. We need and search for order in a vast world of impressions and knowledge. Humans have a mathematical mind that enables and drives us to think in an orderly way.

Children in Montessori preschools classify information through comparing and discriminating. The young child is shown how to categorise, for example, domestic and wild animals, vegetables that grow over the ground and under the ground, etc. Then they learn parts of animals and plants, discovering which animals have feathers, which have scales and so on.

When children pass 6 years, they move into the phase where they expand intellectually and classification becomes even more important. Grammar is a classification exercise whereby children sort words. Not only does it help them to understand grammar better, but it is fun and creates an interest in words and their functions. The creating of the orderly system grounds the knowledge and makes a structure from which creativity can grow.

Biology is the subject where classification becomes the most useful. Long ago, scientists saw the need for biological classification in order to manage the vast array of animals and plants in this world. Children, from an early age, group animals and plants. This grouping becomes more complex as the children develop. Classification is now based on more detailed characteristics of the animals or plants.

Classification exercises are important, not simply for the sake of knowledge, but for the mental structures they create. *Engrams (memory traces)* have been formed and will remain in the unconscious. Even when the child has forgotten about the animal and plant kingdoms, the potential to categorise things by their characteristics is still there. This is a key to intelligence.

14. Supporting Intellectual Development in Practice

Ideas on intellectual development are based on Dr. Montessori's and other educationalists' views on how the intellect is formed.

We must return to the practical aspect of this theory. The role of the adult is often one of holding back rather than being an active teacher. This also applies to supporting intellectual development.

It is more important to encourage the development of deductive reasoning than it is to simply impart knowledge.

Intellectual development must happen as naturally as possible and is based largely on subconscious processes. The child's natural in-built mechanisms for learning must be allowed to work through spontaneous activity. If the teacher always chooses the child's work, engrams may not associate spontaneously because the interest is not strong enough.

Freedom of choice is essential. A spontaneous choice made by a child is one that will produce the best results. The job of the adult is to create an atmosphere where that can happen.

15. Independence and Montessori Materials

The Montessori method of education includes many practical ways of implementing this philosophy of independent development and learning. Dr. Montessori designed many wonderful materials to support her philosophy. Each material is designed in a way that encourages the development of concentration and independent learning.

It is a quick reference rule for Montessori teachers to say, "Trust the materials!" Montessori materials are *not* teacher's aids. They are teachers in themselves. Many of the materials are so good at explaining an abstract concept in a concrete manner that adults experience a great feeling of wonder when they use them. When a teacher worries about how to use the materials, he often finds that by simply trusting the material and not worrying about 'the right answer' or the 'right way', the material itself provides the best solution. This rule applies even more to the children.

When the children have been shown how to use the material in the correct way, they will often experiment with using it in different ways. This should be encouraged. Pre-school children learn new ideas from each other and from their personal experimentation. For the older children, teachers can propose interesting tasks to encourage such experimentation. In fact, it is useful to give the adolescents the materials without a presentation, asking them to find out how they ought to be used. This is not only enjoyable, but they also gain great practice in making reasoning deductions.

Children may not always experience the same wonder with the materials as adults do, simply because they have been over stimulated. Dr. Montessori stressed that quality of experience cannot be replaced with quantity of experience.

Older children have, in many instances, so many activities in school that they can never get the peace of mind to go deeply into any one activity. They move from activity to activity, 'fugitive contacts' as Dr. Montessori called them. The teacher has an important

role at this point. She can remove many of the stimuli, objectively present exercises and wait patiently for the concentration to begin. Montessori said a child who does not have clearly defined and limited external stimuli is a "slave to superficial sensations" (Montessori, M., *The Absorbent Mind*, Chapter, Discipline and the Teacher, 1988)

A control of error in materials supports the development of independence and builds the child's self-esteem.

The control may be physical in that a piece does not fit if the exercise is not completed correctly. It may be dependent on the child's perception, it looks wrong. The control may be in the form of 'master sheets', where the answers or correct versions are provided, and the child may check their answers when finished working. Teachers sometimes ask what to do if the child 'cheats' and looks at the answers before she is finished. The answer to this is that the child is obviously not enjoying the work or may not be ready for that work. The teacher's responsibility in this case is to find a solution to that, perhaps re-present the materials in a different exciting way or find a new, more suitable exercise.

15.1 *Presentations*

The manner of presentation of materials is of great importance. It is a vital part of this process that the teacher presents "lessons, exact and fascinating, given in an intimate way" (Montessori, M., *The Absorbent Mind*, Chapter, Discipline and the Teacher, 1988).

How will the children believe this material is exciting if it is not presented to them as such? It is not the teacher's task to force the child to work with the activity. It is the teacher's task to make the activity exciting enough to attract the child. It might help teachers to remember that the most important thing is not to learn to do mathematics or grammar or whatever the material is designed for, but rather to learn to get deeply involved in the exercise. Present many activities, be patient and eventually every child will find something.

Teachers must present in a clear, precise manner, drawing the child's attention to the materials in whatever way is necessary at first. The teacher must 'seduce' and charm the child to attract her to the exercise.

Teachers must spend time preparing the setting, the environment and the atmosphere in the room before he is ready to start presentations. Then he will be able to give a clear, precise and attractive presentation.

In many cases, where children are very restless, it may be necessary to use some compulsion to get a child interested in the first place. It is possible to say to children "You do not have to do this exercise, but I do want you to sit with me and watch while I do it." The teacher should be charming but firm.

Montessori materials provide a simple and clever means of standing back and allowing the child to become an independent learner. They provide the 'gap' between the adult and the child that allows the child to believe with confidence that she has taught herself!

16. Observation & the Teacher

All teachers should take time to sit and observe their class at work. Observation is the means by which you update and keep the prepared environment suited to the needs of the children working within it.

Observation will allow you to spot immediately when concentration begins. Observation will make you more aware of the subtle signs that tell when a child wants to be left alone or genuinely needs adult attention. Observation is also the means by which you can tell when the child is ready to move on to another exercise. When she starts to become restless and bored with the exercises she is doing you can then present something new. Observation will also help you to know what is best to present next to this particular child.

Observation is also a key factor in discipline. The teacher ought to interrupt disruptive behaviour before the child starts to concentrate. Distinguishing between disruptive behaviour and constructive activity is sometimes difficult. If you observe you will become

aware of the small signs that tell which is taking place. Dr. Montessori talks about 'purposeful' or 'spontaneous' activity and on the other hand 'pure impulse'. A teacher can tell the difference by noting the child's control of his voluntary movements and his ability to concentrate. If his legs and arms are not under control it is usually a sign that it is 'pure impulse' and the child is not concentrating. You may stop that behaviour.

Teachers have to train themselves to avoid “helping” children unless it is necessary. Sitting down to observe many times a day is a way for teachers to avoid over-helping.

It is a good habit to sit down to observe between every lesson. This will help a teacher to pause and identify the next thing to be done. When unsure if a child can complete a task or not, it is useful to withdraw to a chair a few metres away and observe from there. Sitting beside a child will not encourage independence. Sitting too far away may cause a teacher to miss the crucial moment when they are needed.

17. Dr. Montessori's Advice for the Teacher

What better way to sum up than with Dr. Montessori's *'Rules for the Teacher'*? These are extracted from a lecture given in Barcelona in 1933. (*The Child, Society and the World*, Montessori, M.1989)

"What is it that teachers must do 'actively' to refine their way of serving and developing human life – in the environment that has been created and adapted specially for children? Above all, a teacher has a real duty to

- 1. Look after the environment in the most careful way, so that it looks clean, light and well ordered. Repair things that are worn through use, mending and repainting, or obtaining some attractive ornament. Like a faithful servant who prepares the house for his master's return.*
- 2. Teach the use of objects and show by example how one undertakes practical tasks. It must be done with gentleness and accuracy so that everything in the environment can be used by anyone who chooses to do so.*
- 3. Be 'active' when putting the child in rapport with the environment and be 'passive' when this rapport is achieved.*
- 4. Watch the children so as not to miss anyone who is struggling to find hidden objects, or anyone who needs help.*
- 5. Go wherever he is called.*
- 6. Listen and reciprocate when he is asked to do so.*
- 7. Respect those who are working without ever interrupting.*
- 8. Respect those who make mistakes without ever correcting them.*
- 9. Respect anyone who is resting and anyone who is watching the others work without disturbing him, without calling him or making him return to his own task.*
- 10. Be 'tireless' in trying to offer objects to those who have rejected them, and in teaching those who still haven't learnt and who make mistakes – making the environment as alive as possible and yet keeping a concentrated silence, using soft words and a loving presence.*
- 11. Make his presence felt to those who are still looking and hide it from those who have succeeded.*
- 12. Appear to those who have finished their work and have made every possible effort, offering them his soul in silence, like a spiritual object*

Activities.

18. Mathematics Activities

Numbers are universal, and by participating in these group activities, the children will interact on a social level, depending on each other to complete the activities, while having fun together. Language skills are not as crucial here, as gesturing can also be used to communicate.

The following materials, The Arena and The Star, were created by a Montessori-inspired mathematics educator, Theodor Feldner. They are based on Montessori principles for materials, such as movement, control of error within the material, and activity-provoking.

These materials can be drawn in the schoolyard with very little investment, and can be played outside. Once the children have been shown how to use the materials, they can be independent of the adults, and thereby able to develop peer social skills on an even deeper level.

18.1 The Arena

(a) Introduction

(b) Addition

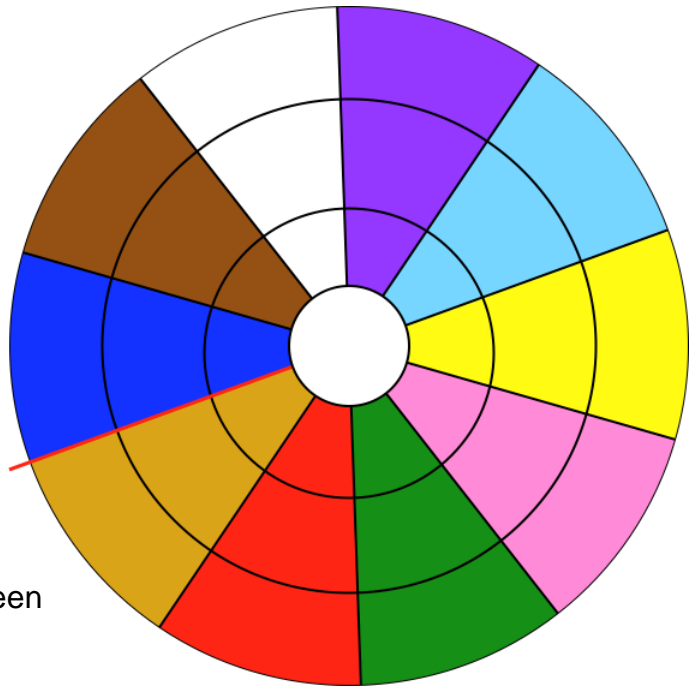
(c) Subtraction

(d) Multiplication

(e) Division

MATERIALS

- Arena mat
- Marker symbols
- Hats (or similar) in red, blue and green
- Bell



PRESENTATION

(a) Introduction

Introduce the mat. Explain the colour systems (see explanation under *Points to Note* below). Point out that there is no space for 10, only for 0. Explain how each ring represents a hierarchy – units are the inner circle, then tens, then hundreds on the outer circle. Play an activity with the children to count through and practice moving over the red line into the next hierarchy. When the units pass the red line (after 9), they move to the zero space and the tens must move up one space.

Have three children stand on the gold 0 spaces- these are the “parking spaces”. Each should be wearing a coloured hat that represents their hierarchy. Say to children “Please go to 724, as fast as you can.” Let them run to the space. Continue to call out numbers and have them run to the places.

Place three children on spaces and ask which number is represented. Have them change places within their hierarchy and ask other students to say which number they are representing.

Alternatively, this can be done by one child. Give them a number with up to 4 digits and have them place a hand or a foot on each corresponding space, to represent the number (like the game “Twister”).



(b) Addition

Simple: Take a problem such as $4+7=$. Begin with one child wearing a green hat standing on the 4 space. They begin walking and count 7 spaces. Have a second student wearing a blue hat ready on the zero space in the units circle for when the units cross the red line. One child can ring a bell when the units child passes the red line, indicating when the tens need to move up one space.

Compound: Take a problem such as $592 + 254 = \underline{\hspace{1cm}}$. Have the units, tens and hundreds children stand on 592. Now begin with units, and walk ahead 4 spaces. Then the tens walk ahead 5 spaces. As they cross the red line, the hundreds moves ahead one space. Continue counting. Then the hundreds child can move ahead 2 spaces. Read off the answer.

(c) Subtraction

Take a problem such as $846 - 254 =$. Have the three hierarchy children with hats on stand on 846. Then beginning with units, walk backwards the number of spaces in each hierarchy. Change as needed: when one crosses the red line, the bell rings and the higher hierarchy moves backwards one space.

(d) Multiplication

Simple: Choose a problem such as $4 \cdot 5 =$. Have all three hierarchy children with hats on standing on the “parking places” (zero). Place a marker on the outside of the circle to indicate the number of times they are multiplying. One child will stand on the outside of the circle and count each time the number is counted. Start with the units and move the

number one time. The counter records this and asks the units to move the number again. Repeat this until the units has moved the correct number of times. (If the units passes the red line, a student rings the bell and the ten must move up one space.) Read off the answer.

Compound: Choose a problem such as $87 \cdot 7 =$. Follow the same principles as above but now units and tens need to move, starting with units. The hundreds will need to move up one space as the red line is crossed.

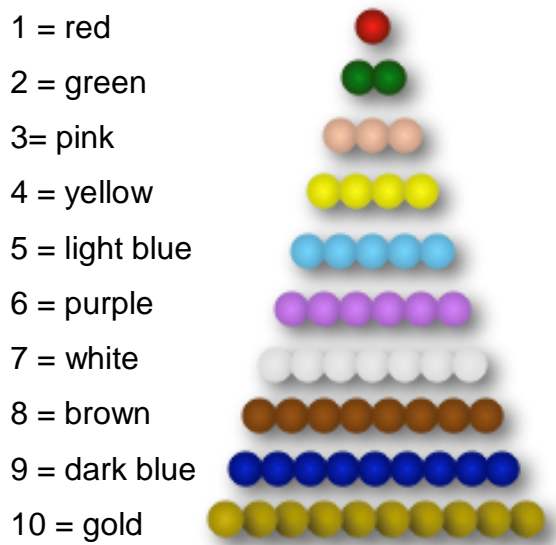
(e) Division

Do a multiplication as above. Ask the children to stay in their places. Explain that they have to do the same job but now it will go backwards. Begin with hundreds and walk backwards toward the parking place.

The result is read off by the counter on the outside of the circle. The answer is what the green units is standing on.

POINTS TO NOTE IN APPLICATION:

Each number from 1 – 10 has a colour associated with it:



Each hierarchy has a colour associated with it, 3 colours repeating:

Units = green

Tens = blue

Hundreds = red

Thousands = green

Ten thousands = blue

Hundred thousands = red

Millions = green

...and so on.

For example, the number 1,235,642 would be

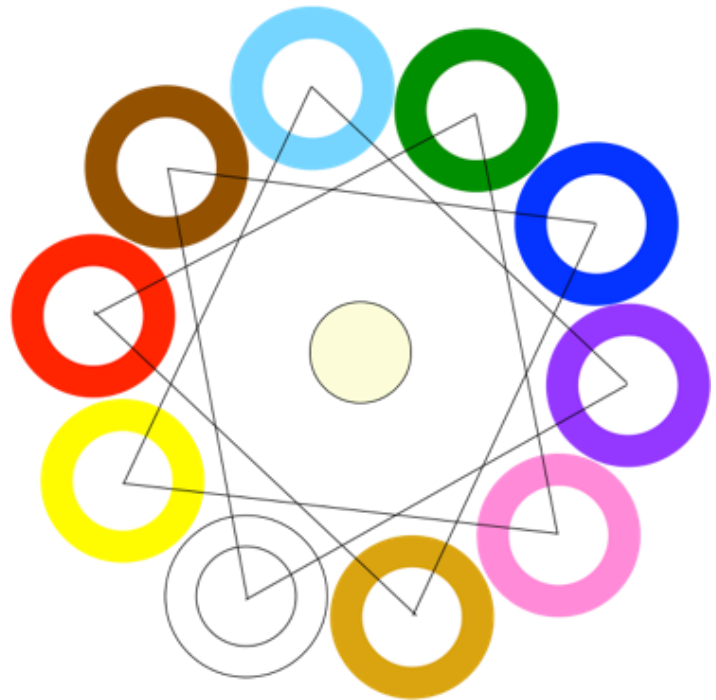
1,235,642

EXTENSIONS:

- Present a dance of the multiplication tables. Choose a number: 9. They can use their foot to count to nine, or they can see that 9 is the same as 10-1, so they can move one place forwards in the tens circle and one backwards in the ones circle.

- Using cones, the children can place cones on each of the numbers (for example 3+4). These cones get moved in the same way as on the stairs in exercise 1, up and down. The child can remove the cone when it gets to zero. This can be done alone or with a partner.
- This material can be used to calculate with negative numbers. If they are a positive number, they are facing forwards. If they represent a negative number, they will face backwards. Continue to move around the circle using the methods described above.

18.2 The Star Mat



(a) Introduction

(b) Operations on the Star

(c) Counting multiples

MATERIALS:

Star mat

Coloured hats- green (units), blue (tens), red (hundreds)

Green, blue and red balls

PRESENTATION:

(a) Introduction

Introduce the material. Point out the red line, showing how it relates to the red line on the Arena mat. Show how the numbers are connected in a decagram pattern. This relates to the “golden ratio”.

Use hats to show units moving to tens. Count along as they move along the star.

(b) Addition

Choose a problem $4 + 3 =$. Have 2 children stand on the star, one on 4 and one on 3. Move up and down as with the stairs in exercise 1. When they arrive on 0, they must move off the mat. Continue until only one is left on the mat.

Subtraction, multiplication and division can follow the same patterns.

(c) Counting multiples

Tossing game: Have children stand on each of the circles. Start a counting exercise where they throw a ball to each other, counting in order, so the ball follows the line. Count from 1 to 9.

Using green, blue and red balls, play the tossing game to count in multiples. Begin with the green ball, and as the counting passes into the next hierarchy, the next coloured ball will be thrown as well.

19. Language Activities










These language materials are classic Montessori materials. Refer to “Advanced Montessori Method, Part II” for more information and to read Montessori’s own description of these materials.

The grammar materials support the child’s mathematical mind as they work to classify words according to their part of speech. They focus on the “job” that each part of speech has in a sentence.

In addition, these materials support social interaction, as the children work together to create new and often funny sentences, playing with the structure of the language. They also will work together in groups with the command cards, which will support reading and oral comprehension.

- Montessori Grammar Symbols – introduction with stories
- The Farm - sentence building using parts of speech
- Grammar Command Cards

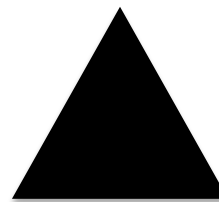
19.1 The Montessori Grammar Symbols

Symbol	Part of Speech	Definition
	noun	A noun gives a name to some person, place, thing or idea.
	article	Articles are demonstrative adjectives. The indefinite articles “a” or “an” are short for “one”. The definite article “the” is short for “this”, “that”, “these” or “those”.
	adjective	An adjective adds to the meaning of a noun or pronoun. They describe nouns or pronouns.
	verb	A verb says something about a person or a thing. A verb is a doing or being word. It is the most important word.
	adverb	An adverb adds meaning to some verb, adjective, and other adverbs.
	preposition	A preposition shows how a noun or a pronoun is related to another word in the sentence.
	pronoun	A pronoun refers to some person or thing without giving it a name. It can take the place of a noun.
	conjunction	A conjunction joins one word or sentence to another.
	interjection	An interjection is used to express emotion. It does nothing in the sentence.

The Stories

(a) The Noun Symbol - a large black pyramid or triangle

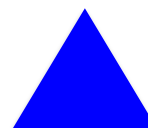
If using the noun pyramid, allow the children to hold the pyramid, feeling its shape and size. They can pass it around the circle as you tell the story of the symbol.



The pyramid is a very old and very stable shape. The base of a pyramid is so large that it provides good support for the rest of the shape. The black colour is a strong colour, and it is also the colour of coal, one of the first and oldest minerals that the very first people on earth discovered. A black pyramid is the symbol for the noun because it is the most stable kind of word. It is also very likely that some of the very first words that the early humans used were nouns. All things, people and places that we love are nouns. Everything has a name, everything is a noun.

(b) The Adjective Symbol - a medium dark blue triangle

The adjective is always connected to the noun. It is part of the noun family, so it is also a triangle. It is not quite as important as the noun, so it is a slightly smaller triangle. However, the colour is almost as dark as the very important noun - a dark blue.



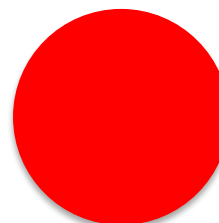
(c) The Article Symbol - a small light blue triangle

The article is always connected to the noun. The article is a triangle because it belongs to the noun. It is part of the noun family. However, the article is not quite as important as the noun or the adjective, so its symbol is a smaller triangle with a lighter blue colour.



(d) The Verb Symbol - a large red circle

The verb symbol is a bright red ball. The colour is bright like the hot sun, which is one of the most important elements in nature, as it gives energy. The verb is the most important word in a sentence because it gives life or energy to the sentence. The verb is always doing something, like the ball that is always moving.



just

(e) The Adverb Symbol

The adverb symbol is a small orange circle. The adverb is related to the



verb, which is why they have a similar shape. It is not quite as important as the verb, so it is smaller and the colour is not quite as strong. The adverb is like a planet orbiting the sun – the verb. The adverb describes the verb. If the verb is “to go”, then an adverb can tell us how: slowly, quickly, or quietly.

(f) The Preposition Symbol



The preposition symbol is like a green bridge that lets us cross over a river. It connects two landforms. Prepositions show the relationship between things. You can be under a bridge, behind a bridge, in front of a bridge or beside a bridge. Words like “under”, “behind”, “in front of” or “beside” are examples of prepositions.

(g) The Pronoun Symbol



The pronoun symbol is a tall, purple, isosceles triangle. The pronoun is jealous of the noun. He wants to be just as important as the noun and take its place. The pronoun is purple because he wants to be important, and purple is a royal colour. The tall shape of the symbol is not quite as stable as the noun, however, and it is almost as if this triangle is standing on its toes to be as tall as the noun.

(h) The Conjunction Symbol



The conjunction symbol is a small pink rectangle. A conjunction is a word that connects other words or phrases. The symbol is like a link in a chain or like a rope. It can also be like two hands holding each other.

(i) The Interjection Symbol



The interjection symbol is a yellow keyhole shape. An interjection expresses feelings, like surprise, anger or joy, and is possibly the first word that humans used – for example, “Ow!” when they burned their finger on the first fire when it was discovered. The symbol is a golden triangle with a circle on top – a combination of the noun and verb symbols. The symbol is yellow or gold because interjections are “the king of all words”. You can also stand the symbol on its head and it because an exclamation point, which most interjections use when we write them in a sentence.

19.2 The Farm

STAGES:

(a) Nouns

(b) Adjectives

(c) Articles

(d) Verbs

Noun	Black
Adjective	Dark blue
Article	Light blue
Verb	Red
Adverb	Orange
Preposition	Green
Pronoun	Purple
Conjunction	Pink
Interjection	Yellow

MATERIALS:

A group of objects for a farm in a basket, with corresponding cards for each part of speech. (The cards are 6x6cm, made on corresponding colours of the grammar symbols.)





(a) Nouns with the farm

Take the farm with the noun cards.
Tell the child she and you are going to put the nouns with the farm. Lay out the objects in rows and name. Ask the child to read a card. Then ask her to find the object. Then ask her to place the card by the object. At the end, read back all the cards.







(b) Adjectives with the farm

Once the child has laid out the farm with the noun, take the adjectives and read one. Decide with the child which noun you would like to place it with. The teacher should place the first one *before* the noun. Encourage the child to change adjectives according to his choice. When all are placed read back.

	Adjective	Noun
	tired	cat
	loud	duck
	lazy	cow
	funny	horse





(c) Articles with the farm

After the child has laid out the farm with noun and adjectives, continue as with the adjectives, showing the child to place an article before each adjective.

	Article	Adjective	Noun
	the	tired	cat
	a	loud	duck
	a	lazy	cow
	the	funny	horse





(d) Verbs with the farm

Ask the child to set out the farm with the first three parts of speech. Ask her to read a verb card and to choose where she would like to put it. Place it after the noun. Ask her to read another and to place it herself.

	Article	Adjective	Noun	Verb
	the	tired	cat	purrs
	a	loud	duck	chews
	a	lazy	cow	sleeps
	the	funny	horse	jumps

(e) Adverbs with the farm

Ask the child to lay out the farm with the first four parts of speak. Ask him to read an adverb card and choose where he would like to put it. Place is after the verb. Ask him to read another and to place it himself.

	Article	Adjective	Noun	Verb	Adverb
	the	tired	cat	purrs	quietly
	a	loud	duck	chews	noisily
	a	lazy	cow	sleeps	late
	the	funny	horse	jumps	clumsily

(f) Farm using advanced parts of speech

You may create cards in each part of speech for the objects used in the activities above. You will present the farm again and explain that now you will include a new part of speech. Present them one at a time, in the order as before. The children can now be a bit freer in the use of the different parts of speech, creating longer and more creative sentences. Note: You will need to have more objects on hand, such as a fence, a tree, etc.

Article

Adjective

Noun

Article

Adjective

Noun

Verb

Adverb

Preposition

Conjunction

Pronoun

Interjection

	the	tired	cat	purrs	quietly
	a	loud	duck	chews	noisily
	a	lazy	cow	sleeps	late
	the	funny	horse	jumps	clumsily



the

funny

horse

jumps

clumsily

over

a

broken

fence



the

funny

horse

jumps

clumsily

over

a

broken

fence

and

a

loud

duck

chews


noisily

19.3 Grammar Command Cards

(a) Verb commands

Show the child the verb command cards. Ask him to read the verb and then act out the verb. He should then take a small red “verb” ball in his hand. Or he may just leave it in front of him while he does the exercise.

*As an easier alternative, you may have a set of cards, each card having a single verb that can be acted out. Show child to read and act out the verb. Children can sit together in a circle and take turns passing the red “verb” ball and picking verb cards to act out.

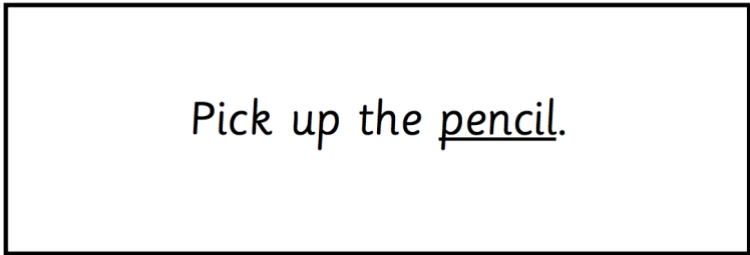


Clap your hands.

(b) Noun commands

Show the child how to read the noun command slips and carry out the action. Then she should place the slip in the lid of the box. It is useful to write the number of slips in the box inside the lid so that the child can check the material when putting it away.

*As an easier alternative, you may have a set of cards, each card having a single noun that can be found in the environment. Show child to read and place noun card by objects in environment. Show how to collect when finished and to count to ensure all the cards have been collected. Write the number of cards inside lid of box or inside packet as a control.



Pick up the pencil.

(c) Adjective commands:

Show the child how to read the adverb command slips and carry out the action, as above. This set will be slips of paper with simple commands that change mainly in the adjective. Underline the adjective with a dark blue line.

Pick up the red pencil.

(d) Adverb commands

Show the child how to read the adverb command slips and carry out the action, as above. This set will be slips of paper with simple commands that change mainly in the adverb. Underline the adverb with an orange line.

Turn around quickly.

(e) Preposition commands

Show the child how to read the preposition command slips and carry out the action, as above. This set will be slips of paper with simple commands that change mainly in the preposition. Underline the preposition with a green line.

Put a book beside the box.

(f) Conjunction commands

Show the child how to read the conjunction command slips and carry out the action, as above. This set will be slips of paper with simple commands that change mainly in the conjunction. Underline the conjunction with a pink line.

Get a pencil and a ruler.

(g) Pronoun commands

Introduce pronoun commands with a group. One child directs a small group of children to follow the commands. For example – I walk to the door; you walk to the door and so on. This set will be slips of paper with simple commands that change mainly in the pronoun. Underline the pronoun with a purple line.

He walks around the table.

(h) Interjection commands

Introduce interjection commands in a group. Children can play this as a drama acting out the emotions expressed by the interjections. This set will be slips of paper with simple commands that change mainly in the interjection. Underline the interjection with a yellow line.

Wow! He just jumped high!

20. Culture Activities

In Montessori, “Culture” covers the traditional subjects of history, geography, arts and sciences. We have included *some* samples of materials for culture. These can serve as a guide for teachers to create their own relevant materials.

- The Cosmic Stories - The Five Great Stories = Curriculum
- Dance of the Planets
- Biology Stories
- Photosynthesis
- Parts of a Tree
- Fundamental Needs of Human Beings - history, geography
- Using Timelines - History

20.1 *Telling Stories*

- (a) Cosmic education and stories**
- (b) The five great stories**
- (c) Inspiring with a story**
- (d) Supporting stories with activities**
- (e) Presentation sequence**
- (f) Other stories**

APPROXIMATE AGE: 5-7 years initial presentation; 5-12 years for other presentations

PRESENTATION:

(a) Cosmic education and stories

In a Montessori elementary school, stories are told as a focal point in cosmic education. They are a starting point in a learning process that is not linear and sequential, but rather depends on the child's interest and enthusiasm to dictate the content of the syllabus. The stories are designed to inspire the children. They will learn the facts as they work with materials and do their own research. The stories do not focus on dry facts but tell what happened with an element of fantasy that captures the imagination of the children.

(b) The five great stories

The Great Stories are five stories of the universe, which have been identified by Montessorians as being the main themes of what Dr Montessori offered as good examples of inspiration for children. The five stories are about:

- The evolution of the universe,
- The evolution of life on earth,
- The evolution of humans and civilisation,
- The evolution of written language,
- The evolution of number.

(c) Inspiring with a story

The child of 6-12 years is in a period where the imagination is the driving force in learning. Dr Montessori based much of her method on creating awe and wonder at the universe. She said that was very easy to do. She used Cosmic Stories. These must be told to the children early in their time at school creating an atmosphere of awe and wonder, appealing to the blooming imagination of the 6-year old. She also said it was very easy to

kill awe and wonder by bringing in many of the traditional methods of learning. Therefore, she urged us inspire the children and touch into that place of wonder in their hearts.

(d) Supporting stories with activities

We offer them activities that act as a platform to continue their interest. But we *offer* activities, never force them upon the children. We must avoid killing natural enthusiasm because children will block out our inspiration. Give children time to become interested. Tell other stories. Do not interfere with their inner process. Just continue giving objective lessons. Observe children who are still not working and try to inspire them with other activities which relate to their own experience.

(e) Presentation sequence

Tell the story as a starting point to a whole cosmic educational experience. Include many the materials and experiments that correspond to the subject areas, using these to support overall cosmic themes as in the stories. To create a whole cosmic experience, you should follow the following sequence in presentation. This may last over 6 years. The children will hear the story nearly every year but will work with more and more advanced materials related to this story as they progress through school.

- Tell the story.
- Show some materials and some experiments.
- Tell the story again bringing in the materials and experiments.
- Continue to expand on the theme bringing in more materials over the child's school years.
- Create cosmic links between subjects. Relate to projects. Inspire to research

(f) Other stories

The concept of story-telling should be expanded beyond the Great (Cosmic) Stories. We suggest further sub-stories of the Great Stories, taking one part and developing it. Cosmic is the word we use to describe the main stories. The "sub-stories" are not cosmic in that they are not about the "whole" universe. But they are cosmic in that they show the connection between all things. Here are some suggestions of stories:

- The story of how the glaciers created Norway
- The story of how the monks in Ireland made the beautiful Book of Kells
- The story of how bees make honey and wax
- The story of poisonous plants in the Amazon

POINTS TO NOTE IN APPLICATION:

- After each story in this manual you will find a list of related materials and experiments from History, Geography, Botany, Zoology and Experimental Science subject areas.
- Use of timelines is not essential in the first telling of the story.
- Educators should develop stories in their own words as these are often more inspiring for the children.
- The contents of the Cosmic Stories will be found in *To Educate the Human Potential* by Dr. Maria Montessori.
- There are many other possible cosmic stories which you may create based around other themes and everyday experiences. It is important to follow the children's interest, as well!
- The science experiments are designed to bring that story into the child's physical reality. The experiments are also lessons in their own right. Involve the children in the experiments after the first demonstration.
- These stories were created some time ago – facts may need to be updated based on new scientific discoveries. Teachers should make sure of their information and adapt stories if needed.

20.2 *The Great Stories: The Creation of the Universe - “God with No Hands”*

The world was created a long time ago. People were not on earth in the beginning. There was a great power that created everything. Sometimes it has been called “God” or sometimes “Mother Nature”. People could always feel it though they could not see it, and they were always asking questions about who it was, what it was and where to find it. It or He or She has no eyes to see with, no hands to work with, and no feet to walk with but this is the power that created the world and controlled how it worked.

In the beginning this power made the light, the stars, the sky and the earth with all the plants and animals. Last it made man.

Everything that was created, whether it has life or not, obeys the will of this great power. They must conform to the laws of the universe – that is their nature.

HOW THE UNIVERSE WAS CREATED

At first there was chaos and darkness, indescribably dark and cold. Can you imagine that darkness and coldness? Our night would be much brighter than that darkness. When we think of cold, we think of ice, but ice is not cold if you compare it with the coldness of space.

[EXPERIMENT 1 – Cold-Freezing].

In this void of cold and darkness light was created. There was a vast fiery cloud which included all the stars that are in the sky, the whole universe was in that cloud and among the tiniest of stars was our own world. But as yet there was nothing except light and heat. So intense was the heat that all the substances we know – iron, gold, earth, rocks, water were gases. All were fused together in one vast, flaming intensity of light and heat. This raging fiery cloud moved in the freezing space. The fiery cloud was no bigger than a drop of water in the ocean of space, but in that drop was contained the earth and all the stars.

As this cloud of light and heat moved through empty space little drops fell from it. If you swing the water out of a glass, some of it holds together as it falls and the rest breaks up into separate drops. The millions of stars are like those drops. Only instead of falling they are moving round in space, in such a way that they can never collide or meet again. All the stars follow special laws. They are millions of miles from each other. Some stars are so far away from us that it takes millions of years for their light to reach us even though light

travels 185,000 miles in one second. Two of these drops were our world and our sun. The earth moves round the sun like a spinning ball.

As the stars were formed and started moving in their own paths there was no longer chaos, Instead of a burning confusion of gases there was to be air, water and rocks.

[EXPERIMENT 2 – Formation of a Star]

The blazing mass that is OUR earth was made up of tiny particles and they were to be transformed into rocks, water and air. The tiny particles all merged together, whirling at a fantastic speed. As they cooled, they moved more and more slowly, clinging closer and closer to each other and so occupying less and less space. This is another law of nature. It has given us the three physical states of matter: gas, liquid and solid. The physical state of matter depends on temperature and how tightly they are pressed together.

[EXPERIMENT 3 – Solid/Liquid/Gas]

[EXPERIMENT 4 – Liquid/Viscous]

So the particles of matter formed into different groups- solids, liquids and gases. If the temperature is very, very hot, hotter than the heat of the sun there will be more gases. If it is very, very cold like the cold of outer space there will be more solids. At a certain degree of heat some matter will be solid, some liquid and some gases. If the heat increases, solids will become liquid and liquids will turn into gases. But not all matter changes at the same degree of heat. Ice changes to water when the temperature is 0 degrees but rock will not change to liquid unless it is really, really hot like on the surface of the sun.

[EXPERIMENT 5 – Solid to Liquid to Gas]

[EXPERIMENT 6 – Gas to Liquid to Solid]

There are millions and millions of different types of particles, each with its special like or dislike for others. Some were attracted to each other. Other particles were repelled by each other. When particles joined many different reactions happened between substances. And so new substances were formed!

[EXPERIMENT 7 – Attraction of particles]

[EXPERIMENT 8 – Forming mixtures]

[EXPERIMENT 9 – Chemical combination of gases]

[EXPERIMENT 10 - Crystallisation]

[EXPERIMENT 11– Chemical reaction]

[EXPERIMENT 12 - Precipitation]

In a solid state particles are made to cling so tightly together that they are almost impossible to separate. In a liquid (or viscous) state particles hold together while inside a

vessel and take the shape of that vessel. Outside they flow and spread, filling every hollow and crevice in their path. Since they do not cling so tightly together they take up more room than the particles of a solid. The gases particles do not cling together at all. They move freely in all directions. You cannot keep air in a cup! And so these laws affected the way the different substances settled in the universe.

[EXPERIMENT 13 – Properties of Solid, Liquid and Gas]

[EXPERIMENT 14 – Elastic, Plastic and Rigid]

The earth and the sun and the stars were balls of gas. The gases of the earth cooled down, and they too obeyed the laws of nature. One after another, at the right temperature, they became first liquid and then solids. As they became liquid or solid their particles would join the other particles to which they were attracted to form new substances.

[EXPERIMENT 15 – Heat changes matter]

And another law was that heavier substances attracted those which were light.

When you throw a stone into a pond it sinks to the bottom. Similarly, the heavier liquids sank towards the centre of the earth's ball, and those that were lighter floated above them like oil floating on water. Thus, they arranged themselves in layers according to their weight but all of them were attracted to the heaviest in the centre and to this day each layer is still pushing on the layer below it.

As the gases surrounding the earth cooled slightly the boiling liquid also began to cool and thicken into a paste. The liquid at the centre remained intensely hot, but it was pushed on all sides by the enormous weight that lay over it. It was not cool enough to turn into a solid, but all the same it began to solidify because of the sheer pressure from above. Sometimes a mass that was pushed on two sides found itself squeezed on top of its neighbours and in this bending process hollows might be formed, which were immediately filled with liquid. Above all of them all stretched a sea of flaming gases.

Can you imagine all this boiling rock and liquid forming itself into shapes on our earth?

Can you imagine the dance of the elements? What a dramatic place the earth was then!

[EXPERIMENT 16 – Density and Gravity]

[EXPERIMENT 17 – The Law of Gravity]

The stars and the sun and the earth gradually grew colder as time went on, and the smaller balls cooled more quickly than the latter. The earth which is tiny compared to the sun, has become quite cold outside, while the sun is still blazing hot.

The way the stars and planets cooled was a wonderful dance which followed the laws of nature, the laws of the universe. Each time the hot gases and liquids soared up to meet

the coldness of space, they shrank in size and became heavier. Then back they fell into the raging fire they had left. Here they grew hot and light again. Then they could rise up once more carrying with them part of the heat from below. Each time heat was carried off into space. Each time they fell back again they carried down some of the ice from outer space into the heart of the fire. Gradually substances cooled in this way. Smaller planets like Earth cooled before larger stars like the sun.

[EXPERIMENT 18- Heat loss and mass]

This process, which went on endlessly, is still happening on the sun today. The heat that the sun gives us from all those millions of miles away is heat that the sun cannot keep for itself. For hundreds, thousands, millions of years the dance went on. More and more gases became liquid, more and more liquids solidified, and at last the earth shrank in size and became wrinkled like an apple. The wrinkles are the mountains and the hollows between them are the oceans and above them is the air we breathe.

As the earth's surface cooled a crust formed. But the heat inside needed to escape. It escaped through little cracks. These are volcanoes! A volcano is a sudden eruption of heat through the surface of the earth.

[EXPERIMENT 19 - Volcanoes]

When a volcano erupts, the gases held within the surface of the earth expand and fill the air around the volcano site.

[EXPERIMENT 20 – Heat expansion]

Because a volcano releases liquids at such a high temperature from beneath the crust of the earth, the liquid turns quickly to gas in the air.

[EXPERIMENT 21 – Heat and evaporation]

Rocks, water, air –solids, liquids, gases; each is what it is because of its temperature. Today, as a million years ago, the Laws of the Universe, the laws of nature, the laws of the great power are obeyed.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(a) Cold/Freezing	<i>In the beginning it was very very cold.</i>	Ice, 2.5 k salt, 2 litre containers, 2 thermometers	Put some small pieces of ice in a container and then a thermometer. Put some ice in another container, then a large amount of salt and then a thermometer. After a while, compare temperatures.	There are much colder temperatures than ice.
(b) Formation of a Star	<i>Substances united in a fireball to form stars. They travelled around obeying the laws of the universe.</i>	Olive oil, pure alcohol, water in a small jug, a glass	Pour some water into a glass - to 3/4 full. Add a few drops of olive oil. Slowly pour near the rim a few drop of alcohol.	The many groups of stars in the sky are like the drops created here, spinning in space
(c) Solid/Liquid/ Gas - naming	<i>The fire was a gas and as it cooled it became liquid and then solid.</i>	A marble, water in a small jug, three test tubes, a test tube holder, 3 labels for Solid, Liquid, Gas	Put 3 test tubes in holder. Put the marble in one, some water in the next and leave last test tube as it is. Name - Solid; Liquid; Gas.	Matter can be: Solid; Liquid; Gas
(d) Liquid-Viscous -naming	<i>As above</i>	Sugar, water in a small jug, 2 glasses, a small spoon	Pour water into two glasses. Add sugar to one glass until water thickens into semi-liquid. Names: Liquid; Viscous (a thickened liquid)	Substance is liquid when it is fluid. It is viscous when thickened
(e) Solid to Liquid to Gas	<i>As above</i>	A piece of wax (paraffin), a spoon, a gas or other burner, matches	Light the burner. Put the wax on a spoon and hold over the flame until there is nothing left.	Matter, when heated, passes from solid to liquid to gas.
(f) Gas to Liquid to Solid	<i>As above</i>	Ice, a pan and lid, a spoon, wax, a burner, matches	Put ice in pan and place over burner. When water boils put lid on. Observe. Collect drips and put in freezer.	Matter, when cooled, passes from gaseous (or vaporous) state to liquid state to solid state.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(g) Attraction of Particles	<i>Some particles flying around the universe were attracted to each other; some were not.</i>	Water in a small jug, sugar, talcum powder, 2 glass bowls, a spoon	Put water in glass, add sugar and stir. Put water in another glass, add talcum powder and stir strongly.	Some particles attract each other and stay joined; others do not attract much and may be separated if joined.
(h) Forming mixtures	<i>The different ways of substances mixing or not mixing lead to many ways of forming new substances. Particles that do not attract can be separated.</i>	Iron filings, sand, a plate, a magnet, a handkerchief	Mix iron filings and sand on a plate. Wrap a magnet in a handkerchief and bring near plate.	Some substances can be mixed but they do not combine. These are called mixtures.
(i) Chemical combination of gas	<i>As above</i>	Ammonia, hydrochloric acid, a glass, a plate	Moisten bottom of glass with a drop of ammonia. Turn over glass onto a plate wet with hydrochloric acid.	When the gases ammonia and hydrochloric acid are combined, a new gas is formed - ammonium chloride.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(j) Crystallisation	<i>As above</i>	Copper sulphate, water in a little jug, a test tube, a gas or other burner, silk or nylon thread, matches	Put little bits of copper sulphate and some water in the test tube. Put test tube on lighting burner, moving it until it forms a saturated solution. While still boiling, put in a tiny piece of copper sulphate tied to a thread. Let solution cool. Take out thread.	Some matter can crystallise when passing from liquid to solid state.
(k) Chemical reaction	<i>As above</i>	Sugar, sulphuric acid, a glass, a glass rod	Fill a glass with sugar to about 3/4. Pour in sulphuric acid until it reaches about half height of sugar. Stir with glass rod. Mixture becomes black. NB - beware of acid - it burns!	A chemical reaction forms a new substance, which did not exist before. Carbon has been formed.
(l) Precipitation	<i>As above</i>	Calcium chloride, sodium carbonate, water in a little jug, a test tube, a small spoon	Pour in a tiny bit of calcium chloride and a little water into the test tube. Stir until it dissolves. Add a few drops of sodium carbonate.	Certain liquid substances combine to form a solid call precipitate. Salt is a precipitate
(m) Properties of Solid, Liquid, Gas	<i>The different substances of the universe have now different properties. Some could not be separated (solid).... - see statement</i>	A marble, a piece of wood, glass jars of different shapes, a little bottle of ammonia, water in a small jug.	Observe the form of the marble and piece of wood. Take two jars of different shapes and fill to overflowing with water. Open the bottle of ammonia and leave open for a moment.	Solid: it has a shape of its own. Liquid: It takes the shape of the containing vessel. If uncontained it goes in all directions except upwards Gas: has no shape; it occupies maximum space and expands in all directions.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(n) Elastic, Plastic, Rigid	<i>AS above</i>	A marble, a rubber ball, plasticine or play dough.	Take the marble, ball and plasticine. Apply hand pressure to each in turn. Names: Rigid; Elastic; Plastic	Rigid: matter that does not change form under normal pressure. Elastic: matter which changes form under normal pressure but goes back to original form when pressure is removed Plastic: matter that changes form under normal pressure but does not go back to original form when pressure is removed.
(o) Heat changes matter	<i>Other laws of the universe stated that bodies can change from one form to another - and heat changes them.</i>	Wax, tin, lead, iron, a tin plate, a glass, ice, a gas or other burner	Place wax, tin, lead, iron on tin plate on lighted burner. Put ice in glass and leave.	All matter changes its state when heated. Each substance has its own temperature at which it changes.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(p) Density and Gravity	<i>Matter in the universe was of different density. The heaviest moved towards the centre of the earth.</i>	4 containers of water (3 litres in each), salt 1) 2 cups salt - 3 drops green (G) 2) 1.33 cups salt - 10 drops red (R) 3) 0/66 cups salt - clear (C) 4) No salt - 4 drops blue (B)	Use eyedroppers to place red liquid in test tube. Put in drops of blue. Observe. Repeat with variations of two - there are 12. GB GC GR RB RC RG CB CR CG BC BR BG Repeat with variations of three combinations.	Liquids that are denser fall to the bottom. Liquids that are lighter rise to the top.
(q) The Law of Gravity	<i>As above</i>	A container, Ping-Pong balls, iron or lead objects, dry sand, a towel, a pan.	Put balls in container. Cover with sand. Put iron and lead objects on top. Cover with towel and shake well. Take towel away and observe.	Earth attracts matter like a magnet. Heavy objects fall towards the earth. Lighter objects remain more distant from the centre of the earth.
(r) Heat loss and mass	<i>As the earth, different parts cooled faster, depending on the quantity of the substance.</i>	A burner, a pan, a bowl, a smaller bowl, a jug of water	Put about 0.5-litre water in a pan and place on burner. When it boils pour a little into a small bowl and the remainder into the other bowl. Let them stand. Dip fingers of both hands into bowls - one into each at the same time. Which is cooler?	Smaller masses cool before bigger masses.

NAME OF EXPERIMENT	STORY OF CREATION	MATERIALS	INSTRUCTIONS	STATEMENT
(s) Volcano	<i>So, the earth when formed was first a ball of incandescent (fiery) substances. The earth cooled and a crust formed. But heat needed to escape. Volcanoes erupted.</i>	Clay, ammonia dichromate crystals, some sulphur, matches OR Baking soda, vinegar and red colouring, a small jug.	Make a model of a volcano with moist clay. Pour some ammonia dichromate crystals and some sulphur into the crater. Light a match on the crystals until some catch fire. OR Put some baking soda in the crater. Add a few drops of red colouring to the vinegar in a small jug and pour into the baking soda.	In the earth there are substances which tend to force out through the surface, creating eruptions including volcanoes.
(t) Heat expansion	<i>The gas heated under the earth expands and explodes into the air around the volcano when released.</i>	Iron box with opening, small iron circle with opening, flask with stopper, water in a small jug, a protective net, matches, a gas or other burner.	Take small iron circle and pass it through opening of box. Heat the circle well and try to fit through the opening. Dry the outside of the flask and half fill with water. Close lightly with stopper and place over heat. Protect by placing net on burner.	All matter, including gas, expands when heated.
(u) Heat and evaporation	<i>The liquid released by the volcano quickly turns to gas in the air.</i>	Water in a small jug, an iron plate, matches, a gas or other burner.	Put a plate on the lighting burner and let it become red-hot. Pour a few drops of water on it.	All matter, when heated, passes from solid to liquid to gas. The stronger the heat, the faster the change.

20.3 The Great Stories: The Cosmic Story of Life

This is the second cosmic fable. We use this story to motivate the children to undertake a study of the story of life. The story is meant to appeal to the children's imagination. It is not a recitation of facts. The timeline of life should be rolled up when you start to tell the story. Gradually unroll the timeline, revealing new information.

Do you remember the story of the earth? Today I will tell you the story of life: the animals, plants and the human beings.

Archaeozoic Era

When the Earth was created, it was beautiful. One day something was not right. It rained a lot; water and gas were washing away the rocks, filling the sea with salt. There were many storms and the water pounded away against the rocks, breaking them apart. The sea was filled with stones and the land was disappearing. The order that was there at the beginning seemed to break down. What was causing this? The water said that it only obeyed the laws it was given. If I get hot I disappear, if I get cold I fall and if I find a hollow I must fall into it and take its form. It is the air's fault. The air said that he was given the job of covering the earth with layers of layers of blankets. The Earth's head and feet are always frozen but its tummy is warm. I always have to pull the blankets over her (circulation of air and winds). It is water who jumps on my back and takes a ride. That is alright as long as it is flat, but when there are mountains I have to drop the water. I think it is the fault of the rocks. The earth is full of wrinkles and bumps and they do not move an inch to let me pass. They get so hot that I have to climb up and so cold that I have to contract. The rocks said they did nothing except sit around. They had to get the warmth of the sun. The rocks accused the sun. Everyone was doing what they ought to be doing, still order was threatened. Something had to be done!

Proterozoic Era

So something else was created. A tiny drop of what seemed to be water, but it was of a jellylike substance. So tiny so you could not even see it. To this tiny drop the great force gave a special job: "I give you something nobody else has. In order to exist you will eat and grow and you will have the power of making others like yourself." So life came in form of little creatures, which looked like drops of jelly and obeyed the commands "Eat, grow and create others like you." They were like tiny little machines for cleaning the sea because they fed on salt and used the salt to build their bodies and some built even shells.

When they died the shell dropped to the bottom of the sea. The salt was still trapped in the shell. New layers of mud were created on the bottom of the sea. They hardened into rock. These layers were like the pages of a book, rock pages of the book of the earth. Some of the pages remained to tell us what happened long, long time ago. When we look into the layers of rock we can find traces of the animals that lived then.

These little machines that were cleaning up the sea were made of only one cell. This single cell had to do all the work. As time went by some of them said, "Why don't we get together? That way, we could do things better." In this way bigger creatures were created. They grew and created others like them. Later some of them thought, "Why should all of us do the same work? Let us share the work and get specialized." Some cells lined up; we will take care of the eating, others said that they would take care of the breathing, etc. In this way creatures with organs were developed.

Palaeozoic Era

(Show animals) Here is the creature made of just one cell. Here is one with two whips for getting around. Here are those who joined together - the sponges. Here are those with waving arms to collect food. We call them sea anemones. We find the trilobites (who absorbed salt) in great number, everywhere. They came in a great variety of forms and sizes. They don't exist any longer.

As time went on many animals appeared. All sorts of experiments were going on. These look like trees but they are animals. They built themselves of little rings of salt, one ring on the top of the other until they looked like this. They had these feathery arms, waving after food. Because they were so colourful they were called sea lilies, but they are not plants but animals.

Some creatures even made their own food from sunlight and water (the algae). They drifted around until one day they said I wonder how it would be on land. The air was full of gas that they could use for food with help of the sunlight. They liked it on land and stayed there. Life was actually trying out land for the first time with the plants.

At the same time a new kind of life appeared. This animal had a kind of a rod inside the body, animals with bones. This animal lead to the first fish, which was very different from the fish we have now. They lay in the mud, buried, waiting for food to drift by. They had no jaw.

The land started to rise up. Parts of the sea were closed off from other parts. Where there was no rain, the sea started to dry up. There were some fish trapped in that water. They

developed a moist sack inside their body in order to breathe outside the water. The sack worked and breathing outside water was invented.

With this new invention there came animals living partly in the water and partly outside the water. We call these animals amphibians. They changed the fins for legs - like the salamander and the frog. With these animals came the first voice heard on land, the first animal sound. The amphibians had a great time on land. There were lots of insects and plants on land now. So the amphibians grew and grew. They had only one problem. They had to stay close to water because of their skin and eggs. So a special skin that would not dry out under the sun together with a shell for the eggs was invented. The shell could hold a little ocean inside. Now the animals could walk wherever they liked. These animals were the reptiles.

Mesozoic Era

The reptiles could eat the plants and the amphibians. The reptiles had a great time and grew and grew to an enormous size. The Diplodocus could be 26 metres long, a lot of its length was in the tail. It developed a sort of second brain in its tail, where the tail goes into the body.

There was another dinosaur, Tyrannosaurus Rex! This one was tall, as tall as a two-storey building. It had a huge head with large teeth. If these two had met, the Earth would tremble.

The reptiles were the lords, they ruled the Earth. But at the same time we find some very small animals. They were afraid of the reptiles. They lived in cold places and they did not need so much food because they were small. These small animals robbed the eggs of the reptiles and ate them, because the reptiles did not look after their eggs. These small animals developed after some time, getting hair, feathers, fur and warm blood. They were birds and mammals, and they knew what happened to abandoned eggs. For this reason they carried their eggs inside their body. The birds could not do this for very long because it was making it difficult to fly. The birds built nests, kept both the eggs and the newborn warm, and fed them. The mammals kept the eggs inside until the young baby was ready to come out. Both birds and mammals stay with their young and protect them until they can take care of themselves.

Cenozoic Era

For some reason the Earth became very cold. The reptiles with no fur or hair died out. Now the mammals had their chance, and they went everywhere, and they got big. Big hippos, big pigs, woolly mammoths! The mammals had a great time. The weather became

colder and colder, and large parts of the earth was covered with ice. The animals moved to avoid the ice, came to new places and spread out. In the end none of the giant mammals survived.

At this time plants started to produce seeds, fruit and flowers. The earth developed some wonderful colours.

Neozoic Era

In the end of the period a new being appeared. This being had no heavy fur, no sharp teeth or claws, but they did have a much larger brain with the power to think and imagine and an enormous power of love. Like other mammals they cared for their children but their love could spread to other beings, other children and also people they had not met.

This new being was man. He could not have appeared before. Now everything was ready for man. The Earth said: "I have spread a thick carpet of grass so you can walk on something soft. I have put flowers in my hair and covered myself with jewels. My cupboards are full of milk, honey, meat and vegetables. Down in the cellar you will find coal and iron. Now that all is ready, it is time for you to come."

20.4 *The Great Stories: Sequence*

- The Story of the Universe
- The Story of the Coming of Life (Evolution)
- The Story of the Coming of Human Beings
- The Story of the Ages of Man
- The Story of the First Civilisations
- The Story of Language / The Story of Writing
- The Story of Numerals

We have included examples for the first two stories. The other stories can be created by the teacher, or many versions are available online.

Points to note:

The Story of the Coming of Human Beings is used to highlight the special gifts of humans:

- *A human mind to imagine*
- *A human hand to work*
- *A human heart to love*

The Story of the Ages of Man and The Story of the First Civilisations are follow-ups to this story.

20.5 *Using Timelines*

There is a vast amount of information that can be taught using timelines. A timeline can cover any length of time and can give an overview of a period of time at a glance. Timelines can be very simple or detailed, depending on the level of the children.

The timelines presented in the Montessori curriculum correspond directly to the Great Stories. They build on each other, showing the linear development of the history of the universe and the history of life, leading to the history of human beings right up to modern times.

These timelines help to put all this information into perspective, and help the child gain an appreciation for everything that has come before and has led to where they are today.

The use of timelines in the classroom is very specific – they are not meant to feed the children facts, but rather to give them an impression of the passage of time and the development of a certain aspect of history, while at the same time sparking a flame of interest that leads to further investigation and research.

Children can also work together to create their own timelines for a themed project they may be working on, or perhaps even a timeline of their life, or their family. Designing their own timeline relates also to mathematics, when calculating span of time and scale of measurement.

We present timelines in the following sequence:

1. Timeline of Eras – a long felt timeline showing the geological development, divided into eras
2. Periods Timeline – This timeline is based on the Era timeline and divides each era into the geological periods.
3. Timeline of Early Man – Referring back to the final era or period on the previous timelines, this shows the development of human beings from Australopithecus to Cro-Magnon

4. Timeline of Ages of Man – Using the timeline of Early Man as a starting point, this timeline shows the ages of man, from Old Stone Age to Civilization (2000 years ago – present day)
5. Timeline of Early Civilizations – This timeline begins at the end of the Ages of Man timeline, showing the earliest civilizations up to Roman Civilization
6. BC / AD Timeline – At this point, the children are using timelines with the year 0 clearly marked. We then present a timeline that presents the divisions BC and AD (or BCE and ACE).
7. Art & Music timelines – Art history and music history can be presented on their own timelines, showing eras or schools through time, timelines of lives of artists and composers.
8. Modern History – These timelines can be created to show modern history of a country, continent, inventions, famous people, and so on.

20.6 *The Dance of the Planets*

MATERIALS:

- Large picture cards with planets – can be hung with string from the children's necks or attached to crowns for their heads.
- String or rope, cut in specific lengths in ratio. For example, .25cm per million kilometres.

Distance from the Sun:

Mercury - 58 million km

Venus - 108 million km

Earth - 150 million km

Mars - 228 million km

Jupiter - 778 million km

Saturn - 1427 million km

Uranus - 2871 million km

Neptune - 4497 million km

The adult or an older student plays the part of the sun. You will give 8 children a planet to wear and a corresponding length of string or rope. You, the sun, begin by introducing yourself. You will then continue to introduce each planet in order. As you introduce a planet, the student wearing the planet will give one end of the string to the sun and then walk until the string is taut. The planet then needs to begin to rotate on its axis in the correct direction and speed, and then orbit the sun in the correct speed. This becomes more challenging as more planets are added to the dance!

To add another layer, play *The Planets Suite*, by Gustav Holst.

<https://www.youtube.com/watch?v=lsic2Z2e2xs>

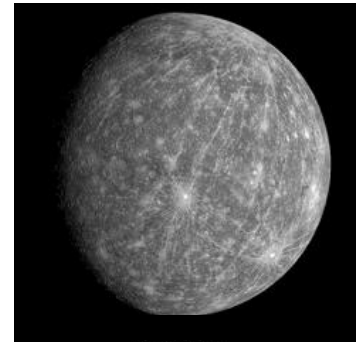
NOTES (with thanks to Claus Dieter-Kaul):

THE SUN

I am the centre of a planetary system that was called "solar system" in my honour. I'm not the only star you humans know. I'm part of a cluster of billions of stars that bears the name Milky Way. I am a sphere filled with gases - mainly hydrogen and helium. I have a diameter of 1.4 million km. My interior can hold over a million planets as big as the earth. I am very important to you humans. I provide you and the other planets with warmth and light. At my core, processes of thermonuclear synthesis take place. As a result, I lose 4 million tons of weight every second, because a very large amount of energy is released. On my surface there are always outbreaks and my temperature is about 1 million ° C.

MERCURY

The Romans named you after the god of merchants and travellers. You are my nearest neighbour and only about 58 million km away from me. You have no moons. You are 20 times smaller than Earth. You turn counter clockwise - and your Mercury Day lasts 58 earth days - longer than half a year. Your journey around me takes only 88 Earth days. Therefore, you are also referred to as the nimble messenger of the gods. Your surface is littered with many craters that were left on you from meteorites. Your surface is similar to the Earth's moon. You have almost no atmosphere because you are too weak and too small to form a bubble around you. During the day you can heat up to 450 ° C. During the night your temperature drops to -170 ° C.



VENUS

Your name comes from the Roman goddess of love. You are about 108 million km away from me. You have no moons. You are not much smaller than Earth. You turn on your own axis in a clockwise direction. Your journey around me takes about 225 Earth days. Your day and night lasts about 243 Earth days. Your clouds contain sulfuric acid. The temperature of the surface reaches up to 480 ° C and the air pressure is about 90 times greater than on Earth. On your surface there are hot lava flows. That's why you're also called a fire planet or a global greenhouse. You are easily seen in the night sky and often are confused with other stars. You owe your unique appearance to the dense and opaque atmosphere that reflects my rays.



EARTH

You are the planet where humans live. You are about 150 million km away from me. You turn on your own axis counter clockwise. Your day and night is 24 hours. Your journey around me takes 365 days. You are the only planet in my system that has large water resources. Water covers 71% of your surface and form wide lakes and oceans, which is why you are also called "the sky-blue planet". About 3.5 billion years ago, life developed in your lakes and oceans. About 400 million years ago, the first plants developed on your surface and 50 million years later, the first species already existed. You have one moon. Its dry, rocky surface covers countless craters. The moon is the only celestial body that people have visited so far, in 1969.



MARS

The ancient Romans named you after the god of war. You are about 228 million km away from me. You have 2 moons. You are almost 6 times smaller than Earth. You turn on your own axis counter clockwise. Your Mars Day is 40 minutes longer than an Earth Day. Your journey around me takes 1.88 Earth years. Long ago, you were very similar to Earth. You had a dense atmosphere and a mild and humid climate. After most of the gases in your environment evaporated into space, you became cold and dry. The average temperature of your surface is -63°C . Only in the periods of the largest "Mars heat", the temperature reaches about 0°C at the equator. You have the largest volcano in the solar system, as well as a huge gap not far from the equator that is several kilometres deep and longer than the largest canyon on Earth. The dust in your atmosphere makes for a golden sky colour



JUPITER

You have the same name as the Roman god of light, who ruled over all other gods and celestial phenomena. You are about 778 million km away from me. You have 16 moons. You are the largest planet of the solar system. You could fit 1321 Earths inside you. You turn on your own axis counter clockwise - so fast that your day and night lasts less than 10 hours. Your journey around me takes about 12 years. In your atmosphere, strong winds blow from west to east. In your southern hemisphere you have an area that is called a large red spot. Your surface is not hard. Your interior is an iron core that appears to be metal hydrogen, and is surrounded by liquid hydrogen. Your interior is covered with a thick gas layer of hydrogen and helium. The bright stripes on your surface are the places where the heated gases escape. The temperature of your clouds is about -130°C .



SATURN

Your name comes from the Romans for the god of peasants and agriculture. You are about 1427 million km away from me. You have 18 moons. You could fit 764 Earths inside you. You turn on your own axis counter clockwise. Your day and night length is only 10 Earth hours. Your journey around me takes about 30 Earth years. You are surrounded by a "halo", a ray of light caused by the refraction of my rays, consisting of frozen ammonia crystals. Your rings are more visible from Earth than Jupiter's. They contain dust, rocks, and bits of ice of various sizes, which can reflect light very well.



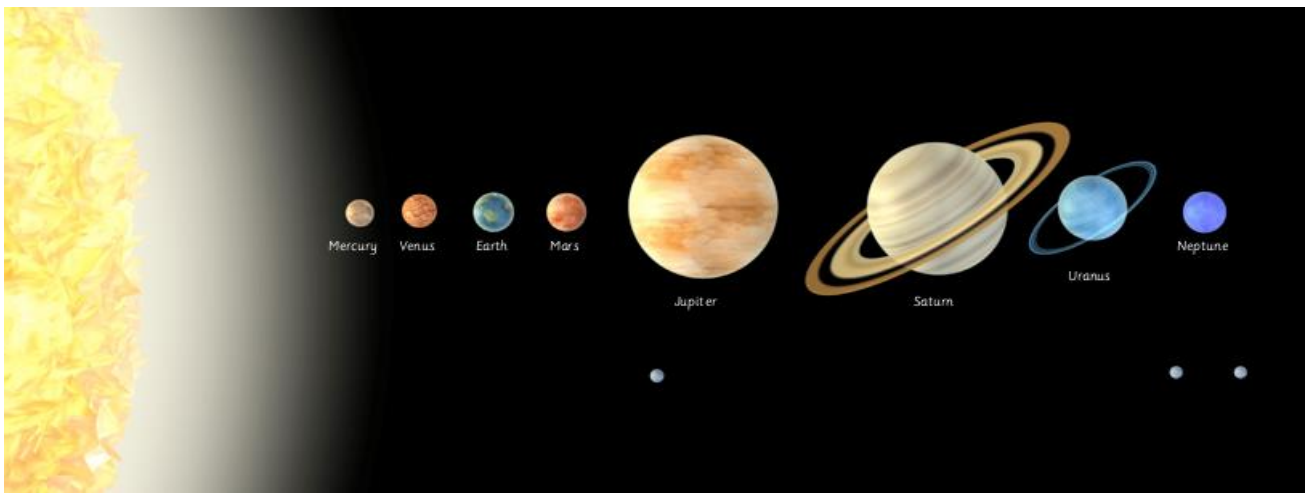
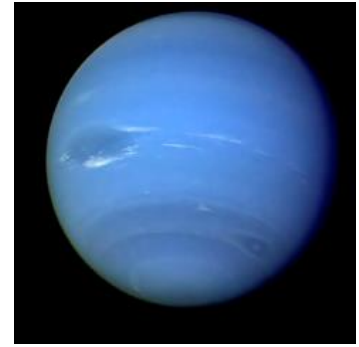
URANUS

You are named for the god of heaven in Greek mythology - husband of the earth goddess Gaea. You are about 2871 million kilometres away from me. You have 20 moons. You are 63 times bigger than Earth. You turn clockwise on your own axis (just like Venus). Your journey around me takes 84 Earth years. Your atmosphere is made up of hydrogen, helium, and methane, which create your beautiful blue-green colour. The average temperature of the atmosphere is about -214°C .



NEPTUNE

Your name comes from the Roman god of the seas and oceans. You are about 4497 million km away from me. You have 18 moons. You are about 58 times bigger than Earth and look like Uranus. You turn on your own axis counter clockwise. This takes you 19 Earth hours. Your journey around me takes about 165 Earth years. You are surrounded by a system of rings, and your surface is covered with ornate, thin, white strips of clouds. Your climate is particularly cold, because the average temperature is about -200°C and the winds can reach a speed of up to 2000 km per hour.



20.7 *Let's Build A Tree: A Story (Parts of a Tree)*

This story is a drama of the inner and outer parts of the tree. Students may already have studied the parts of a tree through other card materials and puzzles.

The teacher tells the story while giving directions to the group (in italics).

Two people stand back to back in the middle of the room.

"You are heartwood - the power of the tree. The task of the heartwood is to keep the trunk and the branches upright so that the leaves get enough sunlight. The heartwood is very old - it is already dead, but still very important. When it was still alive, the many tiny little birds transported the water from the roots to the leaves. These are but now clogged with resin and m.

Approximately 4-5 people sit on the ground and lean back against the heartwood. - TAPROOTS

You are the very long roots - the taproots. Dig deep into the earth up to 10 meters deep!

You suck the water out of the ground and anchor the tree to the earth.

You prevent the tree from falling in a violent storm.

About 5 persons with long hair lie down on their backs - with their feet towards the heartwood - and spread their hair as far as possible to the ground. - LATERAL ROOTS

You are the lateral roots. There are hundreds and thousands of you. You grow from the taproot in all directions - like the branches - but in the earth. At the end, there are tiny roots. When you feel water near you, your cells will grow in that direction to absorb it. The root tip has cells as hard as a crash helmet.

6 people or more surround the heartwood - with their faces facing the heartwood - and touch each other's hands - XYLEM

You from the part of the tree called Xylem. You pump the water from the roots to the highest branches. You are the most effective pump in the world - but with no moving parts. You are capable of pumping up hundreds of gallons of water per day at a speed of 150km/h.

After the roots have absorbed the water from the earth, it is your job to transport it up to the branches and leaves. When I say: Transport the water up! You make a noise like "Weeeeeee!" and stretch your arms upwards.

PHLOEM / CAMBIUM

On the inside of the tree - in front of you - is the cambium. It is the part of the tree that is growing. Every year it adds a new layer of xylem and phloem.

In your part of the tree, the food made in the leaves will be transported to all parts of the tree. When I say- "make food!" then you raise your arms and flutter with both hands (the blades) to absorb energy from the sun and produce the food. And when I say, "Transport the food down!" then you crouch down and make a sound like: "Yeeeuuhhhh!"

The rest of the group, which is not yet integrated in the tree, turns in a circle around the tree, face to the wall, without touching the tree. - BARK

You are the bark!

You must protect the tree from fire, insects, extreme temperature fluctuations and boys and girls with pocket knives.

You have to go in a position like a boxer and point your elbows out.

Now the tree starts to work and the adult plays the bark beetle.

[After some ups and downs and the intense experience of working a tree, there is a round of applause.]

20.8 *Photosynthesis*

(a) Photosynthesis

(b) The Story of Photosynthesis

MATERIALS:

- Photosynthesis chart and card set
- Tree elves, water mice, carbon fliers in felt pieces
- Large tree mat

PRESENTATION

(a) Photosynthesis

Present the chart showing the cycles in photosynthesis. Discuss the elements involved and the exchanges that occur in the cycle. The children may refer to the definition cards for more explanation.

(b) The Story – Tree Elves, Water Mice and Carbon Fliers.

This story is a fable showing a more detailed version of photosynthesis.

I would like to tell you a little story about tree elves, water mice and carbon fliers. You must know that in a tree many other creatures live there besides birds, fleas and bumblebees.

These are the tree elves. They are so small that we cannot see them. They live in every single leaf of the tree. In the summer, when it's hot, you can sometimes hear them moaning. When the tree is thirsty and hungry, they whine loudly.

(Show chart 1)

If you sit under a tree in the summer and are very quiet, you might just hear them.

There are a few more creatures that we cannot see. Another one is the water mouse. The water mice live down at the roots of the tree, in the earth where it is always cool and where there is enough water. If we could see them we would find them in every water droplet.

(Show chart 2)

The tree elves call loudly for the water mice, because they are so thirsty and hungry, and they sweat quite dreadfully.

“Hello water mice, it is so warm, and our tree is very hungry, its leaves are already very limp. Can you bring us some water?”

And then the water mice make their way and bring the thirsty elves some water.

(Show chart 3)

The little green elves can cook a meal out of it, well, something like that anyway.

The elves want to start making food, but they still need something important!

The carbon fliers!

(Show chart 4)

When the sun is shining there are many carbon fliers all around. Unfortunately, we cannot see them either, because they are as transparent as air.

The elves attract the carbon fliers with their beautiful singing. Through tiny openings on the underside of the leaves, they slip in and go to the little elves.

The carbon fliers like to come and join the water mice and the tree elves.

There is a lot of activity going on in the treetop, like a big party. The elves immediately get to work. We can imagine it this way: They put everything in a giant pot and stir vigorously.

(Show chart 5)

First, the carbon fliers separate. The result is black carbon and red oxygen. The red oxygen does not like that very much because they feel very lonely.

(Show chart 6)

The red oxygen stretch, out their empty hands and try to catch hold of a second red oxygen in their little hands. Whenever two have found each other, they hold hands and fly away together. This is how we constantly create new oxygen, which we humans need to breathe.

(Show chart 7)

The black carbons do not want to remain alone, so they form a long chain. One carbon shakes hand with the next. You might think the carbons are now satisfied, but no. They are greedy fellows and have four hands, so everyone has two left. Luckily, there are still the water mice, which the elves have separated from each other by all the stirring. From the water meadows the red oxygen and the white hydrogen are created. The tiny little hydrogen gives his hand to carbon.

Ah, there's some oxygen left! He cuddles himself to the carbon and gives him a hand. On the other hand, he is still a little cold and so he calls for a small hydrogen and gives him his free hand.

Gradually, the chain slowly fills up.

(Show chart 8)

At the top is still a white hydrogen and in the end, what happens there? The last oxygen simply gives the carbon both hands and so everyone is happy and content and nobody has to be alone.

(Show chart 9)

What you see there now is the soup of the tree elves they cooked so that the tree can satisfy its hunger. Scientists call this soup glucose. You also know it called dextrose.

What I have described to you now is called a chemical reaction.

After such a busy day, the little tree elves are completely exhausted and need rest.

In science these tree elves are called chlorophyll. They did not get anything from the soup for themselves. They only prepared it. Again, the scientists have a name for this - substances that are necessary for a reaction, but do not change themselves, they call catalysts.

So every day, new oxygen is created, which we so urgently need to breath.

However, it is not possible without sun and without water, to cook a soup for the trees and plants.



Chart 1



Chart 2



Chart 3



Chart 4



Chart 5



Chart 6



Chart 7



Chart 8



Chart 9

20.9 *Classification in Biology*

- (a) Domains/ Kingdoms chart**
- (b) Kingdom of Animals classification**
- (c) Large chart for Kingdom of Animals**
- (d) Phylum Chordata**
- (e) Sub-phylum Vertebrata**
- (f) Large chart of Phylum Chordata**
- (g) Kingdom of Plants classification introduction**
- (h) Large chart for kingdom of plants**
- (i) Kingdom of Plants**
- (j) Plants - divisions, sub-divisions, classes, sub-classes**

MATERIALS:

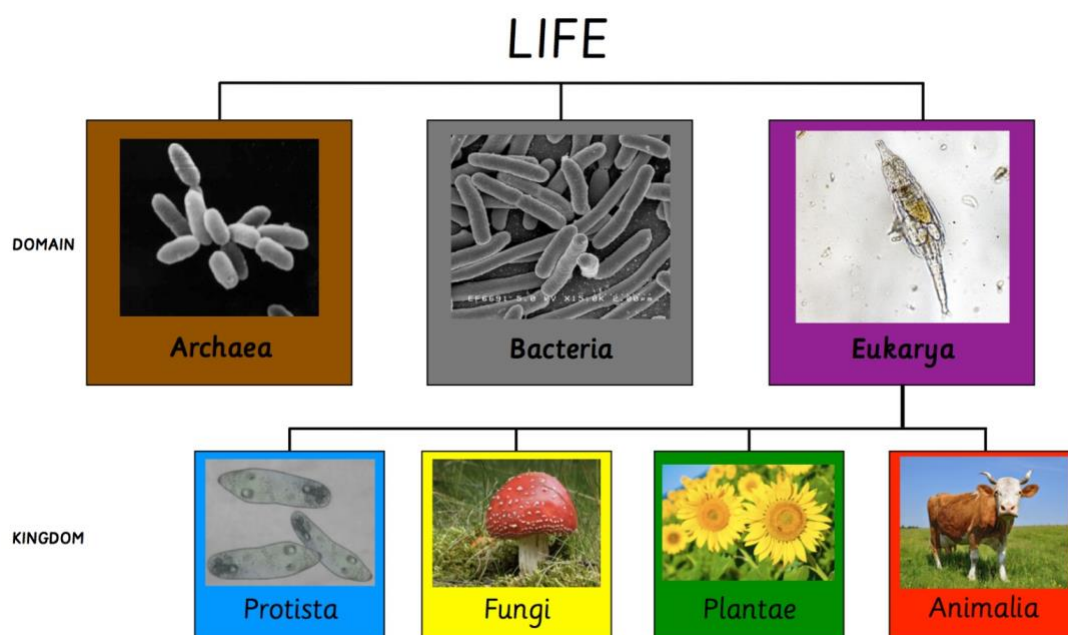
- Domains/ Kingdoms chart
- Linear presentation for the kingdom of animals.
- Large chart showing entire hierarchy of kingdom of animals represented by pictures together with a blank chart and loose pictures to place on this.
- Linear presentation for the Phylum Chordata and sub-phylum Vertebrata.
- Large chart showing entire hierarchy of Phylum Chordata represented by pictures together with a blank chart and loose pictures to place on this.
- Identification of animals chart
- Kingdom of Plants linear presentation
- Kingdom of Plants large chart and matching pictures
- Identification of plants chart
- Packets of cards for:
 - i. Kingdom of Plants
 - ii. Divisions
 - iii. Sub-Divisions
 - iv. Classes monocotyledon and dicotyledon

PRESENTATION:

(a) Domains/ Kingdoms chart

Give the children (a group of three or four is ideal for this type of presentation) a brief account of the history of classification. See notes. Present the domains/ kingdoms chart.

Explain to the children why scientists decided to classify life into these groups. See notes. Discuss the characteristics of each. Find pictures in books or on computer programmes to show examples of each kingdom. Encourage the children to prepare diagrams of the domains and kingdoms



(b) Kingdom of animals classification

Relate to the Domains/Kingdoms chart if the child has done this. Show how to lay out the cards of the linear presentation of the Kingdom of Animals, checking the numbers to get the sequence right. Give the names and discuss the characteristics of each phylum. Ask the children to see if they remember the names of each. They can read them. Then leave them to continue matching and placing name labels. They can discuss and compare. Later they can read the definitions and make their own books or friezes. This should lead to seeking real life examples for each phylum. Extend with question cards, projects and other activities

(c) Large chart for Kingdom of Animals

Present the large chart for Kingdom of Animals. Talk about the pictures in the phyla. Show classes and families explaining that these are sub groups of the row above. Present blank chart and show how to do matching exercise by placing pictures. When child is familiar ask him to place the pictures on the blank chart and then to check with control chart. Extend with question cards, projects and other activities

(d) Phylum Chordata

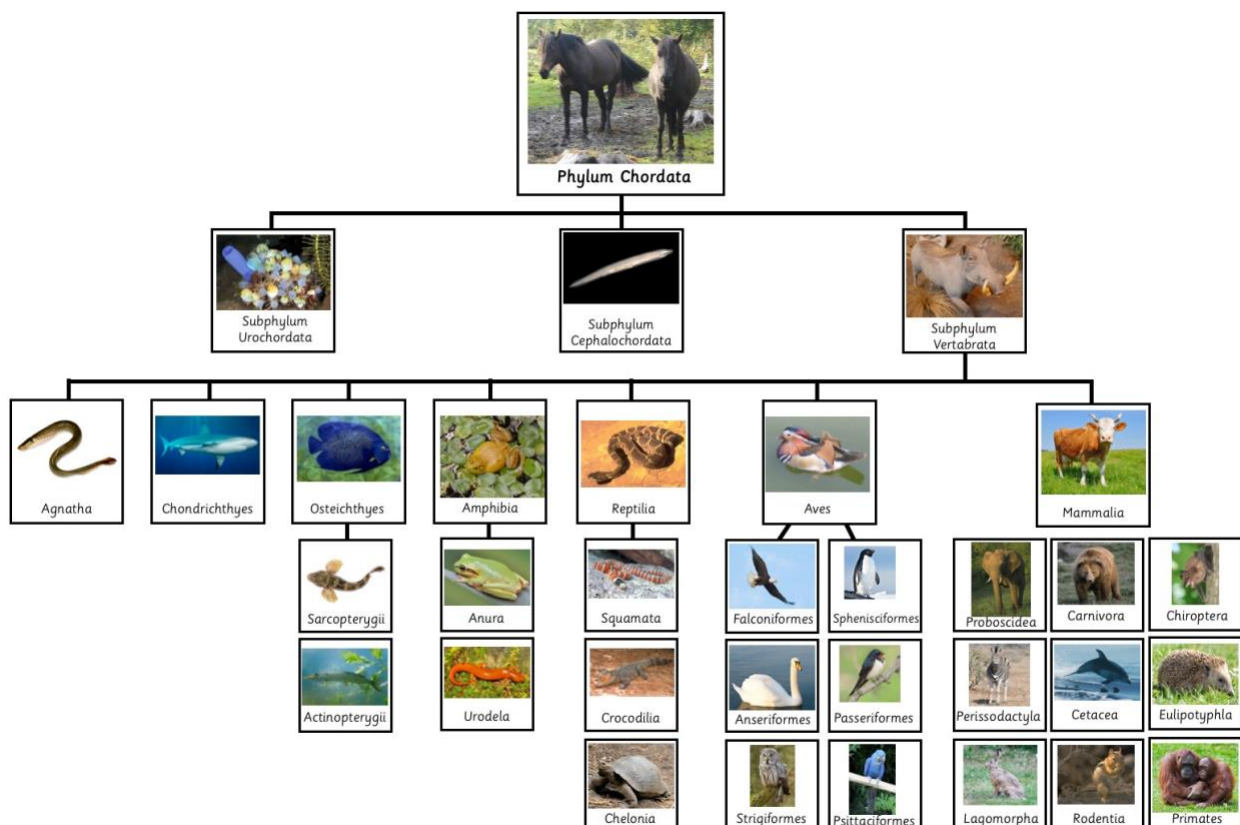
Explain that you will now study one phylum in detail. Present Phylum Chordata in the same manner as kingdom of animals. Explain about the chord in some animals connecting nerve ends and the brain. Relate to humans and animals known to children

(e) Sub-Phylum Vertebrata

Explain that you will now study one sub-phylum in detail. Present Sub-Phylum Vertebrata in the same manner as Kingdom of Animals. Explain about backbones in certain animals. Let the children research what animals have a backbone.

(f) Large chart of Phylum Chordata

Present the large chart (this includes Phylum Chordata and Sub-Phylum Vertebrata). Talk about the pictures in the classes. Show families and orders explaining that these are sub groups of the row above. Present blank chart and show how to do matching exercise by placing pictures. When children are familiar ask them to place the pictures on the blank chart and then to check with control chart. Extend with question cards, projects and other activities.

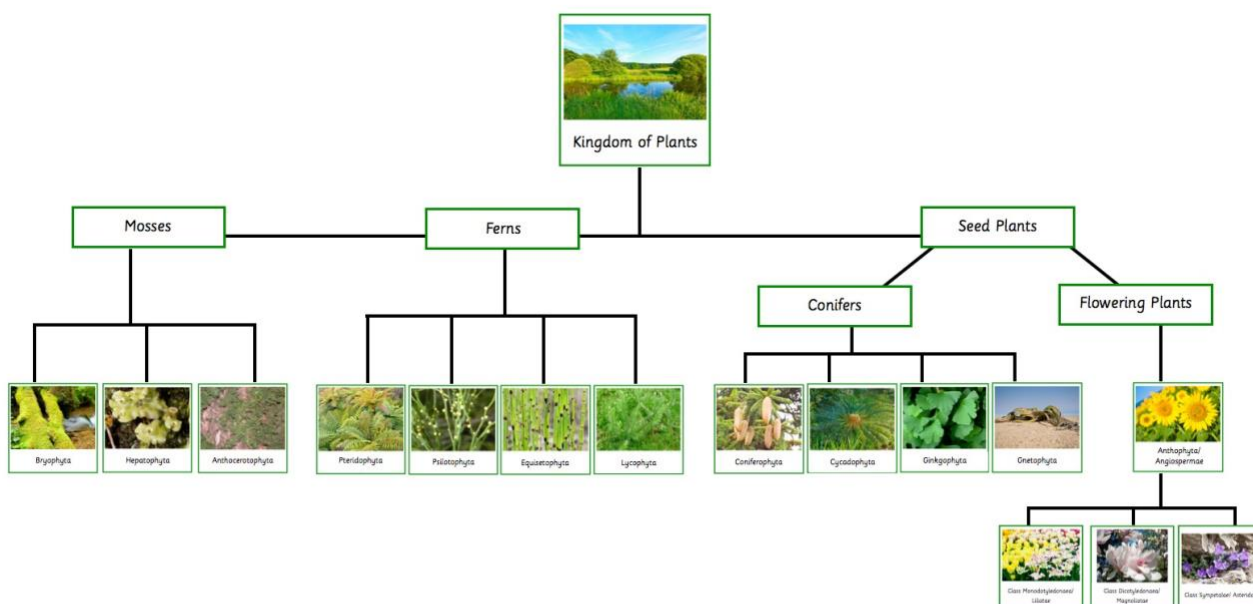


(g) Kingdom of Plants classification introduction

Relate to the domains/kingdoms chart if the child has done this. Show how to lay out the cards of the kingdom of plants, checking the numbers to get the sequence right. Give the names and discuss the characteristics of each division. Ask children if they remember the names of each. They can read them. Then leave them to continue matching and placing name labels. Later they can read the definitions and make their own books or friezes. Develop questions, games and activities to encourage discussion and comparison. This should lead to seeking real life examples for each division.

(h) Large chart for Kingdom of Plants

Present the large chart with pictures. Explain its layout to the child. Take the blank chart and place it below this. Lay the pictures on the mat. Place the pictures on the blank chart, discussing them and naming the categories.



(i) Kingdom of Plants

Review the Kingdom of Plants. Present the kingdom of plants chart and the linear presentation. Allow the children to explore. Compare to real plants. Set tasks, questions, games and projects to help the children to learn more using this material.

(j) Plants – divisions, sub-divisions, classes, sub-classes

Present the first packet for Kingdom of Plants relating it to the chart. Tell the child that she may find the next group on the chart in one of these packets. You will help her find it when

she needs it. The child works through the packets in sequence. Continue working with sub divisions in the same way. The child should be able to work alone with this material but may need inspiration and guidance at different stages.

POINTS TO NOTE IN APPLICATION:

- These exercises are variations on the same theme
- Extend these exercises with question cards, projects and other activities
- The characteristics of each phylum and sub-phylum or divisions are central to these exercises. Attractive pictures and outdoor activities will enhance this work.
- Relate to the Periods timeline (Timeline of Life) to show that evolution and classification are connected.
- Loose cards with control numbers may be used. Or you may use a frieze as a control.

20.10 *The Tree of Life for the Animal Kingdom*

(a) Present the packets for the Tree of Life for Animals

(b) Present layout of Tree of Life for Animals

MATERIAL:

- The packets and cards for the tree of life for animals – the packets fit into each other according to the classification system
- Control charts for Tree of Life for the Animal Kingdom
- Kingdom of Animals chart

PRESENTATION:

- (a) Show the child the packets. Explain how the packets fit inside each other. Relate to Kingdom of Animals chart.
- (b) Demonstrate the layout of the chart. The children can do this work over a period of time, working in groups of 2 or 3.

20.11 *The Tree of Life for the Plant Kingdom*

(a) Present the packets for the Tree of Life for Plants

(b) Present layout of Tree of Life for Plants

MATERIAL:

- The packets and cards for the tree of life for plants – the packets fit into each other according to the classification system
- Control chart for Tree of Life for the Plant Kingdom
- Kingdom of Plants chart

PRESENTATION:

(a) Present the packets for the Tree of Life for Plants

Show the child the packets. Explain how the packets fit inside each other. Relate to Kingdom of Plants chart.

(b) Present layout of Tree of Life for Plants

Demonstrate the layout of the chart. The children can do this work over a period of time, working in groups of 2 or 3.

20.12 Fundamental Needs of Human Beings

- (a) Needs of human beings - basic introduction
- (b) Needs of human beings - each category
- (c) Needs of human beings - all categories
- (d) Relate needs of human beings to history
- (e) Relate needs of human beings to political geography
- (f) Relate needs of human beings to economic geography
- (g) Relate needs of human beings to ecology
- (h) World religions

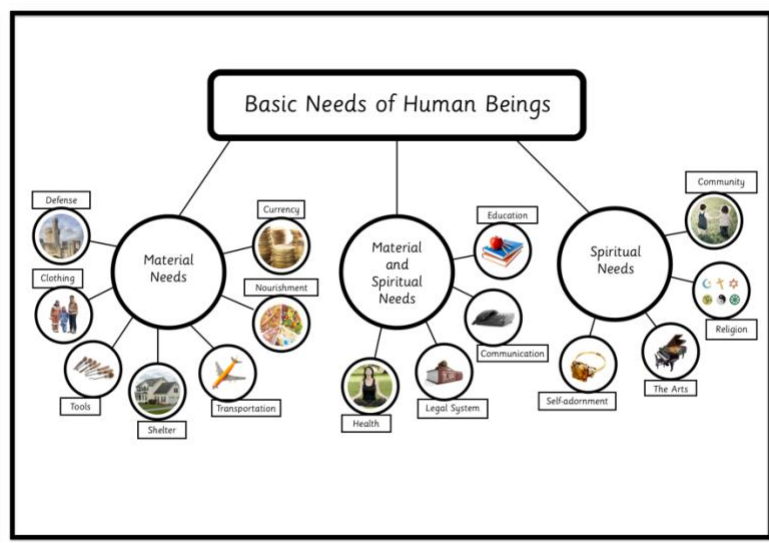
MATERIAL:

- The needs of human beings chart
- Activity cards
- Early man, ages of man and civilisation timelines and cards
- Materials on ecology
- Materials on religions through the history of humans

PRESENTATION:

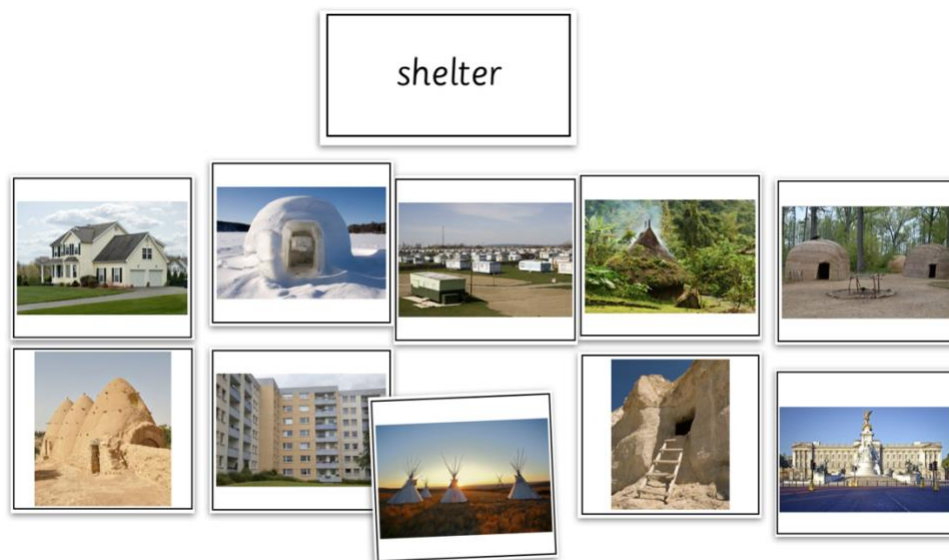
(a) Needs of human beings – basic introduction

The teacher presents the Needs of human beings control chart, discussing each category in relation to the lives of the children and their families. Start with the basic physical needs and move towards the spiritual needs. Show the children how to lay the loose cards onto the working chart. The children can draw their own charts.



(b) Needs of human beings - each category

Present a single category of human needs with a set of picture cards showing various types of how humans satisfy these needs. Allow for discussion in the group. The children should be encouraged to add new picture cards to the set, based on their ideas of how humans satisfy this need (perhaps it varies from culture to culture).



(c) Needs of human beings - all categories

Once the children have investigated individual categories, you may combine some or all of the sets and allow the children to sort them into the categories. Encourage the children to discuss within the group.

(d) Relate needs of human beings to history

When doing the early man, the ages of man or early civilisations use the needs of human beings chart and analyse with the children when humans acquired each need. Lay the loose cards on the timeline.

(e) Relate needs of human beings to political geography

When discussing the different needs of human beings, relate to different continents or cultures and analyse with the children how people from different geographical areas satisfy needs differently. You may lay out a comparison using category cards from the chart down the left side and continents across the top, filling in with picture cards.



(f) Relate needs of human beings to economic geography

When studying economic geography especially in the context of 'exchange of services', trade and commerce, the needs of human beings chart can be introduced to show what needs we provide for each other. Children can role-play different providers in society and use the cards to show how services are exchanged.

(g) Relate needs of human beings to ecology

When studying ecology and the balance of nature introduce the Needs of Human Beings chart. Discuss with the children which needs can be supplied within an ecosystem. Use the loose cards to place in a diagram of an ecosystem. Discuss the implications of human needs creating imbalances in ecosystems.

(h) World religions

Present material and books on world religions. Relate it to the timeline of man, to the AD/BC timeline, to the timeline of civilisations and to modern history timelines. Relate to Needs of Human Beings chart and projects. Relate to Geography projects on culture, war and peace. Relate to philosophy and personal beliefs. Encourage the children to research.

POINTS TO NOTE IN APPLICATION:

- The Needs of Man chart can be used in different ways. It is central to cosmic education.
- It is a useful tool for cultural inclusion through comparison
- Teachers should use it in as many ways as possible, inspiring the children to see connections between different areas of study.
- This exercise can be presented in many different ways. The chart is the basic presentation but activities can be many and varied.

20.13 A Project

STAGES:

- (a) Introduce the topic to the children – for this example: The Potato
- (b) Information around the project
- (c) Activities related to project
- (d) Arts and crafts related to project
- (e) Practical life related to the project
- (f) Language related to the project
- (g) Music related to the project
- (h) Outings related to the project

MATERIALS:

- Materials available from all areas of a well-prepared environment.

SEQUENCE:

- Parallel to other activities in environment.

APPROXIMATE AGE: 5-6 years upwards

PRESENTATION:

- Introduce child to theme at circle or gathering time, *for example: the potato*
- Get feedback from children
- Ask children questions - draw out information from them
- Introduction to world continent map. Discuss journey of potato to Europe - find Peru and Bolivia on map
- Time Line showing the historical journey of the potato from South America to Europe
“Once upon a time there was a potato...”
- Matching cards:
 - > Potato life line from time to planting until time of harvesting
 - > Varieties of potatoes
- Recipe cards
- Jigsaw puzzles
- Literature
- Arts and Crafts

- > Drawing
- > Painting
- > Making world map
- > Pirates
- > Salt dough
- > Wooden disks, pipe cleaners, felt
- > Potato printing
- Practical life - gardening - potato patch
- Cooking
- Language
 - > Discussion
 - > Child makes time line or book
 - > Child makes recipe book
- Music
 - > Find melody for song written in gathering time
 - > Sing relevant songs
 - > Write song during gathering time
- Visit farm
- Project can be stretched backwards by going into depth about Bolivia or Peru, the Inca civilisation, the invasion from Europe.
- It can also be stretched forwards by going into depth about:- root vegetables, vegetables and fruit and where they grow, fruit and vegetables that grow on bushes or trees, the farm, the seasons, from a farming point of view and farming culture and tradition.

21. Recommended Reading for The Montessori Method

21.1 Recommended Books by Dr. Maria Montessori

Montessori, Maria (2007) *The Montessori Method* ISBN-10: 9562915824; ISBN-13: 978-9562915823

Montessori, Maria (2010) *The Advanced Montessori Method, Volume 1* BiblioBazaar, LLC; ISBN-10: 1142386139; ISBN-13: 978-1142386139

Montessori, Maria (1989) *The Advanced Montessori Method, Volume 2*; Schocken Books, New York

Montessori, Maria (1989) *The Formation of Man*; ABC - CLIO Ltd; ISBN-10: 1851090975; ISBN-13: 978-1851090976

Montessori, Maria (1989) *Education for a New World*; ABC - CLIO Ltd; ISBN-10: 1851090959; ISBN-13: 978-1851090952

Montessori, Maria (1997) *Basic Ideas of Montessori's Educational Theory*; ABC - CLIO Ltd; ISBN-10: 1851092765; ISBN-13: 978-1851092765

Montessori, Maria (1992) *Education and Peace*; ABC - CLIO Ltd; ISBN-10: 1851091688; ISBN-13: 978-1851091683

Montessori, Maria (1989) *To Educate the Human Potential*; ABC - CLIO Ltd; ISBN-10: 1851090940; ISBN-13: 978-1851090945

Montessori, Maria (2009) *Dr. Montessori's Own Handbook*; BiblioBazaar; ISBN-10: 1113691794; ISBN-13: 978-1113691798

Montessori, Maria (1989) *What You Should Know About Your Child* - ABC -CLIO Ltd

21.2 *Recommended Books About Montessori*

Britton, L. (1992) *Montessori Play and Learn: A Practical Guide for Parents and Children*; Vermilion; ISBN-10: 0091752140; ISBN-13: 978-0091752149

Chattin-McNichols, J. (1991) *The Montessori Controversy*; Delmar Cengage Learning; ISBN-10: 0827345178; ISBN-13: 978-0827345171

Eissler, T. (2009) *Montessori Madness! A Parent to Parent Argument for Montessori Education* Sevenoff, LLC; ISBN-10: 098228330X; ISBN-13: 978-0982283301

Feez, S. (2009) *Montessori and Early Childhood: A Guide for Students*; Sage Publications Ltd; ISBN-10: 1847875165; ISBN-13: 978-1847875167

Goertz, D. B. (2001) *Children Who Are Not Yet Peaceful: Preventing Exclusion in the Early Elementary Classroom*; Frog Books; ISBN-10: 1583940324; ISBN-13: 978-1583940327

Gross, M. J. (1985) *Montessori's Concept of Personality*; Dissertation, Univ. of Nebraska, 1976; University Press of America

Gutek, G. L. (2004) *The Montessori Method: The Origins of and Educational Innovation*; Rowman & Littlefield Publishers, Inc; ISBN-10: 0742519112; ISBN-13: 978-074251911

Hainstock. E. G. (1998) *Teaching Montessori in the Home: Pre-school Years*; Penguin Putnam Inc; ISBN-10: 0452279097; ISBN-13: 978-0452279094

Hainstock. E. G. (1997) *Teaching Montessori in the Home: School Years*; Penguin Putnam Inc; ISBN-10: 0452279100; ISBN-13: 978-0452279100

Hainstock, E. G. (1997) *The Essential Montessori: An Introduction to the Woman, the Writings, the Method and the Movement*; Penguin Putnam Inc; ISBN-10: 0452277965; ISBN-13: 978-0452277960

Healy Walls, C. (2008) At The Heart of Montessori Series; Original Writing Ltd

Healy Walls, C. (2006) Montessori in a Nutshell-Available from Waterpark Montessori

Healy Walls, C. (2007) The Conscious Parent Original Writing Ltd

Isaacs, B. (2007) Bringing the Montessori Approach to Your Early Years Practice; Routledge, ISBN-10: 1843124327; ISBN-13: 978-1843124320

Kilpatrick, W. H. (2008) The Montessori System Examined (American education: its men, ideas, and institutions. Series II); Kessinger Publishing, LLC

Kramer, R. (1988) Maria Montessori: A Biography; Da Capo Press; ISBN-10: 0201092271; ISBN-13: 978-0201092271

Lillard, A. S. (2008) Montessori: The Science Behind the Genius; Oxford University Press, USA; ISBN-10: 019536936X; ISBN-13: 978-0195369366

Lillard, P. P. (1982) Montessori: A Modern Approach; Schocken Books, New York; ISBN-10: 0805209204; ISBN-13: 978-0805209204

Lillard, P. P. (1997) Montessori in the Classroom: A Teachers's Account of How Children Really Learn; Schocken Books, New York; ISBN-10: 0805210873; ISBN-13: 978-0805210873

McTamaney, C. (2007) The Tao of Montessori: Reflections on Compassionate Teaching; iUniverse Star; ISBN-10: 1583482989; ISBN-13: 978-15834829

Montessori, M. M. Jr. (1992) Education for Human Development: Understanding Montessori; ABC – CLIO Ltd; ISBN-10: 1851091696; ISBN-13: 978-1851091690

Mwape, J. (2008) The Montessori Method: An Alternative Way of Teaching Science; VDM Verlag Dr. Muller Aktiengesellschaft & Co. KG; ISBN-10: 3639087577; ISBN-13: 978-3639087574

Seldin, T. (2006) How to Raise An Amazing Child the Montessori Way; DK Publishing; ISBN-10: 075662505X; ISBN-13: 978-0756625054

Signert, K. (2000) Maria Montessori: anteckningar ur ett liv; Studentlitteratur AB

Stevens, E. Y. (2010) A Guide to the Montessori Method; Unknown; ISBN-10: 114818466X; ISBN-13: 978-1148184661

Wennerström, K. S. & Smeds, M. B. (2009) Montessoripedagogik: i förskola och skola