

MONTESSORI EDUCATION METHOD AND APPLICATION IN ORGANIZATION OF SCIENTIFIC DISCOVERY ACTIVITIES AT PRESCHOOL

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Abstract: *Montessori is a method of educating children based on the research and development of Maria Montessori, an Italian physician and educator (1870-1952). The Montessori method of education is recognized by the international community and has been applied to primary and secondary schools in many countries around the world. In the article, the author presents some general issues about Montessori education method and provides activities to apply this method in scientific discovery activities for preschool children based on the goals of the field of cognitive development and content for scientific discovery activities, thereby to promote children's active activity, to stimulate their curiosity in discovering things and phenomena around them, to train children's skills and lay the foundation for learning at all levels for continuing education and lifelong learning.*

Keywords: *Montessori method, scientific discovery, scientific discovery activity*

I. Introduction

Maria Montessori set out the educational goal as “the development of a perfect human being, towards the environment, time, space and culture adaptation where the person lives”. This adaptation is the ability to respond to the requirements of new contexts, the preparation for children's successful lives. The Montessori education method is based on her observations of children in diverse cultures and in many countries.

Therefore, her discoveries are not only her principles, but also universal principles of human behavior, in all peoples, societies, and cultures. She uses a variety of descriptions of these behavioral trends, including exploration, navigation skills, repetition, accuracy, imagination, the ability to arrange, communicate, manipulate, and control errors to achieve perfection. Classes are better organized when the teacher understands the need to continually provoke these behaviors in children - behaviors that will help the

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child adapt to society. Therefore, with scientific discovery activities, building a rich, positive and diverse environment of activities is an opportunity for children to nurture their interest in discovering and exploring things, practice observation, comparison, classification, judgment, attention and intentional memory skills, be able to detect and solve simple problems in different ways, have an understanding about people, things, and phenomena around them. Science discovery activities for preschool children must be a “party” for children to explore, a real world for children to experience.

However, at present, the application of the Montessori method to scientific discovery activities in preschools still faces many difficulties. Therefore, this study will present some general issues about the Montessori method of education and give suggestions on how to apply the Montessori method in scientific discovery activities for preschool children at preschool institutions in Vietnam.

II. Methods

In this study, the author uses the following research methods: (1) descriptive research (qualitative description) is used to propose scientific discovery activities for preschool children; (2) the method of content analysis aims to systematically and objectively describe the goals of preschoolers' cognitive development, the content of scientific discovery for preschoolers; (3) Theoretical research method is used by the author to give a

general introduction about Montessori education method.

III. Results and Discussion

3.1. Some general issues about the Montessori education method

3.1.1. The philosophy and characteristics of the Montessori education method

The Montessori education method is built on the belief that children can develop their capacity by themselves and they will maximize their available potential when supported to find their own path of capacity development, in an environment specifically designed to meet the needs of the child at each stage of the development. Montessori's philosophy is in the same direction as that of famous philosophers and educators such as Rousseau, Froebel, Pestalozzi. Based on the belief that a child possesses innate traits will manifest himself in a natural environment that freedom, creativity, social interaction, movement and learning through practice are centered, many of the same principles could be found in our preschool program. The Montessori method provides a learning environment that meets the unique needs of each child's developmental stage. Adults with knowledge of the child's developmental stages will act as a guide to help children find their own natural pathway. The education program is designed to be relevant, scientific, engaging and intended to support a child's development. Children are free to participate in their own developmental order over time.

There are three basic characteristics of the Montessori education method. The first is the educational legal practice that emphasizes the individual character and independence of the child. A child's independence is formed from a specially designed classroom environment. Children perform "work" according to their own schedule and pace. The outstanding feature of the Montessori method is respect for the individuality, independence, and disciplinary freedom of each child. Besides, this method highly respects the child's natural physiological development, as well as fully equips them with practical knowledge. Therefore, educating children with the Montessori method will build a basic foundation for each child from the first years of life, especially the period from 2 to 6 years old. Thereby, the child is equally developed in terms of the brain, the ability to acquire knowledge as well as to form social skills very early, to have independent learning skills, effective communication and a spirit of cooperation and high unity. AMI (American Montessori International) and AMS (American Montessori Society) have given some characteristics of children's activities in the Montessori classroom as follows: (i) Children are free to choose activities according to their interests and abilities; (ii) The child's activity process is not interrupted; (iii) Children learn through practical experience with teaching aids and visual models. The second is the teaching of education through sensory experience. Montessori builds an educational environment with

a teaching system consisting of real objects, specific models arranged in the corners of the Montessori classroom. It can be manipulated with teaching aids by experimenting with activities and training the sensory sensitivities of sight, hearing, taste, smell and touch. Through that, children can easily perceive knowledge, abstract concepts, thereby developing their cognition and language development. The third is an educational method with a mix of ages in the classroom. The classroom is built as a miniature society with an age gap between children. If in a traditional classroom, children learn at the same age, the Montessori classroom has children of different ages (for example, a mix of ages 3-6), children have the opportunity to share and learn from each other's experiences. Younger children are inspired by activities from older children, or older children guide younger children in activities, thereby contributing to develop their confidence, teamwork skills and leadership skills etc...

3.1.2. Children's sensitive stages

Children aged 0-6 years have a sensitive period. Children are very sensitive to a certain object or movement, through spontaneous actions, they can do that movement many times until satisfied to stop. When the child has reached the goal, that feeling will be lost and replaced with another sensitivity. Children have six sensitive stages: sensitivity to language, manipulation and movement, order, socialization, senses, attention to small objects and movement.

In a sensitive period, children often use their senses to experience and perceive the world around them. It is very difficult for children under 3 years to understand abstract concepts and it is also difficult for us to teach children about colors, short and long sizes, flavors, high and low sounds, different shapes ... Quick Path Especially children use their eyes to see, touch with their hands, hear with ears, use their nose to smell, use their mouth to taste, so that they can repeat, compare, distinguish and observe to understand. When children repeat a movement or are extremely attentive to a movement, it can be understood that this experience plays a very important role in enhancing brain connectivity, having a direct influence on the child's development. The sensitive period is extremely important for a child's development because this is the period when children can practice a certain ability easily and comfortably. Therefore, by designing an environment so that children can "freely" operate, they will have the opportunity to develop a certain special ability and develop their own abilities.

3.1.3 The core elements of the Montessori classroom

The central element of the Montessori classroom is a prepared educational environment and trained teachers. It is an environment in which the teacher prepares the environment, the children use the environment to develop themselves, the adults must prepare the natural environment that does not hinder

the child's development and is prepared in accordance with the children. For example, shelves for teaching aids, coat hangers, tables, and chairs should fit the child's height. The environment must stimulate and arouse children's needs and interests; the environment is full of freedom, love, warmth and no stress. The environment must include many natural, authentic and realistic elements like the real life of the children.

The elements that make up the Montessori classroom include: (1) Freedom: Forming an inner law through the development of independence and will, developing the ability to make choices, knowing what to do to be happy and knowing limitations. (2) Have a clear structure (layout) and sequence: The environment is interactive, divided into operating angles, and materials are arranged sequentially according to a certain principle. Materials are arranged from easy to difficult, from simple to complex, from visual to abstract, from large to small, and are arranged on shelves from left to right, from top to bottom. This order helps children know what to do next, thereby facilitating both the level and tempo of the next activities, helping them to progress learning and mature quickly. (3) Reality and nature: Real things, natural things. There cannot be two identical sets of materials in one class. This is a fact in real life: we cannot own an object when it is in the possession of another person. (4) The atmosphere is warm and aesthetic: The beauty is rustic, pure,

clean, neat, orderly. (5) Montessori teaching materials: good quality, beautiful design -> arousing children's interest. Teaching aids not only provide accurate knowledge and techniques, but also give children the opportunity to develop their own psychology and creativity. (6) There is the development of community spirit: In the development of children, it is necessary to have "concentration". In the Montessori classroom environment, children do not interfere with the attention of others, there is also love, care, sharing and mutual support between them.

3.1.4. Roles and working stages of Montessori teachers

The teacher of the Montessori classroom is the person who creates the Montessori environment while also plays a role in connecting the children with the environment. Without a Montessori teacher, the school environment, no matter how well prepared, would not work. Montessori teachers have the role of: (1) Preparing the environment (equipping, arranging, supplementing, collecting, and making teaching aids; (2) Observing, capturing details and details of children's activities (3) Respecting people. Unfailingly learning spiritual development of the body; (4) Exposed individuals interested in loving children, the role of a youth mentoring; (5) Recognizing function force of children, guided "indirectly" by sincerity and humility.

The working stages of Montessori teachers are demonstrated through the following steps: Step 1: Organize, maintain and protect the learning environment. All activities that Montessori teachers need to do lie in the preparation process. Teaching aids are arranged scientifically according to the Montessori method given. The necessary items in a kit should be fully prepared, kept clean, ready for use. Step 2: Help children who are confused, do not know their direction and have not focused on their activities. Teachers can let children do activities even though they may not like and enjoy them at first. Teachers engage students with fun activities. Step 3: After the child has an interest, the teacher can step back to observe and avoid disturbing the child's activities. While the child is active, the teacher observes and writes on the observation sheet, thereby evaluating the child's level of accomplishing the activity, understanding the child's thinking and personality. Teachers always answer the questions themselves: What are the children doing? What problem do children want to solve? Why do children want to do that? What is the child's level of accomplishment? How is the child's emotional and expressive state? How to promote children's development? Teachers do not interfere with children's activities in any way when they do not receive signals from children for help. Helping, asking questions, or giving praise while a child is engaged in an activity can also affect a child's concentration of attention.

3.2. Objectives in the field of cognitive development and scientific discovery content for preschoolers

3.2.1. Objectives in the field of cognitive development

- The objectives of the cognitive development of preschool age in the preschool education program are described as follows:

- Curiosity, love to explore the surrounding things and phenomena.

3.2.2. Scientific discovery content

- Ability to observe, compare, classify, judge, pay attention, and memorize intentionally.

- Ability to detect and solve simple problems in different ways.

- Being able to express understanding in different ways (by actions, images, words...) with mainly spoken language.

- Have some initial understanding of people, things, surrounding phenomena and some rudimentary concepts of Math.

Content	3 to 4-year-old	4 to 5-year-old	5 to 6-year-old	
1. Parts of the human body	Functions of the senses and some other parts of the body.	Functions of the senses and other parts of the body.		
2. Objects: Utensils, toys Transport	Outstanding features, uses, usage of tools and toys.	Characteristics, uses and usage of utensils and toys. Some simple relationships between structural features and the use of familiar utensils and toys.		
		Compare the differences and similarities of 2-3 utensils and toys. Classify utensils and toys according to 1-2 signs.	- Compare the differences and similarities of utensils, toys and their variety. - Classify utensils and toys according to 2-3 signs.	
	Names, characteristics and uses of some familiar means of transport.	Characteristics and uses of some means of transport and classification according to 1 - 2 signs.	Characteristics and uses of some means of transport and classification according to 2-3 signs.	
3. Animals and plants	- Outstanding features and benefits of familiar animals, plants, flowers and fruits.	- External characteristics of animals, plants, flowers and fruits, beneficial and harmful to humans.	- Characteristics, benefits and harms of animals, plants, flowers and fruits.	

Content	3 to 4-year-old	4 to 5-year-old	5 to 6-year-old
	<ul style="list-style-type: none"> - Simple relationships between animals and plants that are familiar with their environment. - How to take care and protect animals and close plants. 	<ul style="list-style-type: none"> - Compare the differences and similarities of two animals, plants, flowers, and fruits. - Classify plants, flowers, fruits, animals according to 1-2 signs. - Observe and judge the simple relationship between animals, plants and the environment. - How to take care and protect animals and plants. 	<ul style="list-style-type: none"> - The development process of plants and animals; Living conditions of some plants and animals. - Compare the differences and similarities of some animals, plants, flowers and fruits. - Classify plants, flowers, fruits, animals according to 2-3 signs.
<p>4. Some natural phenomena: <i>Weather, season</i></p>	<p>The phenomenon of sun, rain, heat and cold and its effects on children's activities.</p>	<p>Some seasonal weather phenomena and its effects on human activities.</p>	<ul style="list-style-type: none"> - Some weather phenomena change according to the seasons and the order of the seasons. - Changes in activities of people, animals and plants according to the seasons.
<p><i>Day and night, sun, moon</i></p>	<p>Some prominent signs of day and night.</p>	<p>The difference between day and night.</p>	<p>The difference between day and night, sun, moon.</p>
	<ul style="list-style-type: none"> - Some water sources in daily life. 	<ul style="list-style-type: none"> - Sources of water in the habitat. - Benefits of water to human, animal and plant life. 	

Content	3 to 4-year-old	4 to 5-year-old	5 to 6-year-old
Water	- Benefits of water to human life, animals, trees.		
		- Some characteristics and properties of water. - Causes of water pollution and ways to protect water sources.	
Air, light	Some light sources in daily life.	Air, light sources and its necessity for human, animal and plant life.	
Soil, sand, gravel	Some characteristics and properties of soil, rock, sand and gravel.		

3.3. Application the Montessori method in scientific discovery activities

Based on the required requirements of each age, innovation principles and the ability of children and teachers, we can choose the appropriate content, activities and form of activities.

The following suggestions are for applying the Montessori method in science discovery activities:

Topics	Content	Activities
People and the places they live	My house	<ul style="list-style-type: none"> - Listen to the sounds made by familiar objects in the house - Explore building materials - Compare houses of different countries - Make a model of a house with materials - Make a model of a house with materials - Explore rough-smooth objects - Explore fabrics (by color, pattern) - Game: Arrange the furniture in the rooms - Practice how to use some household appliances
	Neighborhood where I live	<ul style="list-style-type: none"> - Build a scene of the area where the child lives - Make a simple map of the area - Choose the right place and plan a picnic - Visit an elementary school - Make a model of an elementary school
	Vietnam -Homeland – living place	<ul style="list-style-type: none"> - Share about interesting things in Vietnam, the homeland through the use of photos, postcards, travel brochures, etc. - Explore different types of houses and means of transport in the past and present - Play the role of tourists shopping for souvenirs - Visit some scenic spots through video clips

Topics	Content	Activities
Animal world	Pets	Invite the veterinarian to talk about taking care of pets Make houses for pets with blocks or Lego sets Visit a pet store to find food, care products or various accessories. Play the role of people who like animals and show care and love for them.
	Farm Animals	Visit a farm (e.g.: farm growing vegetables, raising animals...) Observe the main characteristics of some farm animals Make a book about animal parts Experience: feed the animals; duck blanket; Get Eggs Play the role of a mother animal looking for her child Make a collage of the feathers of cattle and poultry Make a collage of products from farm animals
	Zoo Animals	<ul style="list-style-type: none"> - Visiting the zoo - Imitate the sounds of animals - Classify animals according to their characteristics and habitat - Make clay models of animals in the zoo - Make a collage of animals using used materials - Make a book of animal parts - Acting as a zookeeper
	Insects	Make books about the parts of ants, spiders and some other insects Visit the ecological garden Observe the main physical characteristics of ants, spiders and some other insects Discovery of butterflies and the life cycle of butterflies Make a book of butterfly parts
	Sea creatures, mollusks	Watch movies about learning about the animal world on the Discovery TV channel Observe some special sea creatures (e.g.: seahorses, pinhead sharks, anemones, starfish). Distinguish fish and dolphins
	Amphibians	<ul style="list-style-type: none"> - Discovery about Frogs and the life cycle of frogs - Make a book about Frog parts - Observe the main physical characteristics of the Frog

Topics	Content	Activities
	Dinosaurs, reptiles	<ul style="list-style-type: none"> - Guess how the dinosaurs became extinct - Compare dinosaurs with other animals - Play as an archaeologist digging for dinosaur fossils - Watch a movie about dinosaurs - Assemble Lego to create dinosaurs - Watch documentaries about the reptile world, the color change of some animals - Make books about parts of dinosaurs and reptiles.
Plants	Tree species	<ul style="list-style-type: none"> - Visit gardens and parks to observe the main parts of trees - Observe the colors, shapes and parts of plants, flowers, leaves, fruits - Make books of parts of plants, flowers, leaves, fruits - Conduct a simple experiment to learn and observe how seeds and plants grow - Collect and observe the seeds of different fruits - Discuss the plants that live in the ground
	Flower species	<ul style="list-style-type: none"> - Visiting flower garden (school garden, park) - Observe the characteristics of some flowers and parts of flowers - Watch the clip “blossom bloom” - Experiment “Flower color change” - Collage, fold, shape into flowers
	Vegetable species	<ul style="list-style-type: none"> - Visiting vegetable gardens (children’s vegetable garden, farmer’s farm...) - Watch movies about the growth of some vegetables, tubers, and fruits - Sorting vegetables, tubers, fruits - Experience: Plow the soil, sow seeds, water plants, harvest. - Pick vegetables, make salad - Make animals from tubers and fruits.
Earth and the universe	Our environment	<ul style="list-style-type: none"> - Conduct a simple experiment to find out if the classroom is clean - Take a walk and the surrounding area or go for a walk on the beach - Make a picture of the products obtained from the sea - Distinguish between land and sea on the globe - Make simple toys/models using recycled materials - Make a poster to introduce the harmful effects of pollution. - Explore the land-water-air

Topics	Content	Activities
	Weather	<ul style="list-style-type: none"> - Describe different weather conditions outside the classroom (e.g.: sunny, rainy, windy, cloudy) Name and identify activities for different weather conditions. - Make a windmill
	Seasons	<ul style="list-style-type: none"> - Discover about spring, summer, autumn, winter - Design models of seasonal activities - Make a book to learn about the seasons of the year
	Atmosphere	<ul style="list-style-type: none"> - Observe which direction the balloon goes when it is deflated - Do a simple experiment to find out the effect of wind on heavy or light objects. - Do a simple experiment to learn the properties of air (e.g.: how to put an egg in a bottle, how to prevent water from overflowing when turning the glass upside down) - Do a simple experiment to find out what is the best material to make a raincoat.
	Stone	<ul style="list-style-type: none"> - Explore the properties of dry and wet ice Compare the properties of sand and soil - Sort stones by shape, color, size and material - Conduct a simple experiment to observe the formation of sugar crystals
	Land surfaces	<ul style="list-style-type: none"> - Explore lakes, islands, bays, peninsulas, straits, isthmus - Make a book about the forms of the earth - Making models of lakes, islands, bays, peninsulas, straits, isthmus.
	Light and shade	<ul style="list-style-type: none"> - Discover the invention of the light bulb - Talk about the importance of light and light sources. - Conduct a simple experiment to show how a shade is formed. - Play with the shadows that create the shapes of animals - Discover how mirrors and shiny surfaces reflect light
	Continents	<ul style="list-style-type: none"> - Explore the continent globe - Learn about the Eastern Hemisphere and the Western Hemisphere - Explore some geographical features of the continents: Asia, Europe, South America, North America, Australia, Antarctica - Making books on all continents - Continent jigsaw - Discover featured animals on the Continents - Discover about the wonders of the countries representing each continent

Topics	Content	Activities
	The universe	<ul style="list-style-type: none"> - Discover the features of the moon, sun and stars - Discover the cycle of the moon - Learn about the solar system - Make a “Star Box” - Make simple toy spaceships - Play as astronauts in space
Food	Type of cuisine	<ul style="list-style-type: none"> - Observe the change that occurs between uncooked food and after it is cooked (e.g.: eggs, popcorn, agar) - Identify and practice using different chopsticks, spoons, knives and forks for different foods - Play as waiters, cashiers, chefs, dishwashers and customers in a restaurant - Visit a supermarket or a grocery store
	Nutritious foods	<ul style="list-style-type: none"> - Classify good and bad foods using the food pyramid - Make a picture of good foods - Let’s talk about the foods that people usually eat for breakfast - Taste some regional foods - Discover different ways to pack food - Visit a mall, a coffee shop or a food stall to see the place and the foods that are sold there.
Means of transport	Road transportation	<ul style="list-style-type: none"> - Discuss and practice some traffic safety rules when crossing the road - Discuss appropriate behaviors when traveling by car, bus, or train - Comparison between types of road transport - Move a toy car downhill from different heights. - Let’s visit a bus stop - Practice: Join the traffic
	Water transportation	<ul style="list-style-type: none"> - Practice making a simple boat - Conduct a simple experiment to see which objects float and which sink - Visit, watch movies, video clips about the harbor or estuary
	Air traffic	<ul style="list-style-type: none"> - Discuss the main parts of civil aircraft and helicopters - Conduct a simple experiment to discover the falling speed of different objects - Watch movies, video clips about an airport and the process of planes taking off and landing

Topics	Content	Activities
World of colors	Color	<ul style="list-style-type: none"> - Watch video clips about “color world” - Observe the effect of basic tinting - Observe how the color changes when using the color mixer - Learn about animals that use colors to camouflage - Do a simple experiment to observe the colors that make up a black inkwell; coloring phase. - Do an experiment to re-polish an old coin - Do an experiment to polish silverware - Shaping: 7 colors of the rainbow - Use materials and colors to create tools and toys
Science magic	Machines	<ul style="list-style-type: none"> - Discover how the phone works - Discover how the pulley, gear and lever work - Determine what type of machinery is used at construction sites - Discuss how people lived before the invention of various machines (e.g.: telephone, TV, computer). - Create strange inventions - Visit a factory - Experiment with magnets (magnetic objects, non-magnetic objects)
Water	The magic of water	<ul style="list-style-type: none"> - Experiment with pouring and measuring water - Experiment “Sink - float” - Introduce children to the concepts of absorption and evaporation by having them dip a rag or tissue in water and then let it dry in the sun. What happens to the water? Which dries faster? Fabric or paper dries faster? Why so? - Use food coloring in different water bottles. What happens when red is mixed with yellow or blue?

IV. Conclusion

In general, Montessori activities are suitable for preschool children, meet the goals and expected results in the preschool education program and promote the child-centered educational perspective. The suggestions in the article help teachers to flexibly apply Montessori activities to choose the content of organizing scientific discovery activities for preschool children to improve

educational effectiveness, promote positive maximize children’s activities, stimulate and develop their abilities to the maximum, laying the foundation for learning at subsequent levels of learning and for lifelong learning.

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