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**INTRODUCTION TO NATURAL SCIENCES IN EARLY CHILDHOOD
EDUCATION THROUGH THE PROJECT SCIENCE WEEK**

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ABSTRACT:

The *Science Week* is a project that is organized to make an approach of natural sciences-knowledge to children that are in early ages, under 6, and developing their vision and perception of the world surrounding them.

In this approximation that it is completely necessary for the correct development of the child in all areas, it is necessary to emphasize the need children have to ask questions and satisfy the curiosity that us just being born in them.

Doing it in a way of let them experiment, feel and sense everything by different activities, and debate everything in assemblies, has shown that provides the child a better learning and comprehension of the environment and natural phenomena that have a place in the reality and in the world.

Key words: Sense of Wonder, Natural Science, Experiments, Knowledge of the Environment, Nature.

RESUMEN:

La *Semana de la Ciencia* es un proyecto que se organiza para realizar una aproximación del conocimiento de las Ciencias Naturales a los niños que se encuentran en edades tempranas y desarrollando su visión y percepción del mundo que les rodea.

Además, en esta aproximación que es totalmente necesaria para el correcto desarrollo del niño en todos los ámbitos, hay que hacer hincapié en la necesidad que tienen los niños de hacerse preguntas y satisfacer la curiosidad que acaba de nacer en ellos.

Hacerlo de manera en que les dejemos experimentar, sentir y palpar todo mediante diferentes actividades, y posteriormente debatir todo en una asamblea, ha demostrado que proporciona al niño un mejor aprendizaje y comprensión del entorno y de los fenómenos naturales que tienen cabida en la realidad y en el mundo.

Palabras clave: Sentido del asombro, Ciencias Naturales, Experiments, Conocimiento del Entorno, Naturaleza.

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LEGAL FRAME

The legal frame for this End of Degree Project (EDP) is based on Ley Orgánica 3/2020, de 29 de diciembre, por la que se modifica la Ley Orgánica 2/2006, de 3 de mayo, de Educación (LOMLOE) developed on the Real Decreto 95/2022, de 1 de febrero, por el que se establece la ordenación y las enseñanzas mínimas de Educación Infantil, and transposed to Community of Madrid normative in the Decreto 36/2022, de 8 de junio, del Consejo de Gobierno, por el que se establece para la Comunidad de Madrid la ordenación y el currículo de la etapa de Educación Infantil. The main difference between Ley Orgánica 2/2007, de 3 de mayo, de Educación and the LOMLOE is that the second one gives an educational character to the first cycle of Pre-Primary Education, which was left apart during all the past years.

According to LOMLOE, in both cycles of Pre-Primary education it is going to be attended the development of elementary guidelines of the discovery of the environment as they are going to develop abilities to coexist with other living creatures and beings with the physical and social characteristics of the previously mentioned ones. As pre-primary education is the moment in the early-aged-ones to develop their identity, the purpose of it is to promote the whole development of the students so at the same time, they acquire their personal autonomy.

As mentioned in *Real Decreto 95/2022, de 1 de febrero, por el que se establece la ordenación y las enseñanzas mínimas de Educación Infantil*, all the knowledge that a teacher must instil in a child has to be based in significant experiences, that are positive emotionally and that can use experimentation as one of the requirements. In article 7 b), it is established that one of the objectives that has to be achieved in Pre-Primary education is the observation and exploration of their social and familiar environment and, at the same time, the natural environment where the other ones are functioning.

Finally, referring what is mentioned on the *Decreto 36/2022, de 8 de junio, del Consejo de Gobierno, por el que se establece la ordenación y el currículo de la etapa de Educación Infantil*, Pre-primary education is a voluntary educational stage and it attends children since birth to 6 years old. In Article 5, between all the different objectives established for this stage, the ones that are best related to the pedagogical objective of the Science Week project are to achieve the capacity to observe and explore the social, natural and familiar environment, to initiate children in the knowledge of all science fields, and

to develop abilities that are related to affection and emotions (this last one is clearly related to the sense of wonder that L'Ecuyer explained). In Article 7, about the areas, it is concluded that 2 of the areas to be developed in this cycle are “The development and exploration of the environment”, and “The communication and representation of the reality” (BOE, 2022), which are truly connected to the perspective of discovering all what nature can give us by the individual's ability to communicate and ask questions. The 11th article sets up the pedagogical principles of making an intervention on these experiences to make them significant, functional and, they must be provided as an experience to children, in an appropriate environment that enhance the relationship children-environment.

On the final appendix of this Decree, the areas are fully developed and the second one deals with the “Discovery and exploration of the Environment”. This area contributes to expand the process of observation and investigation of all the natural elements and at the same time, to grow on children a respectful attitude towards the environment. In doing so, children will progress on developing cognitive thinking strategies on this discovering process. Contents on this area will work around the physical and natural atmosphere that surrounds children along these young ages, and providing an approach to it by object's manipulation, reviewing sensations and trying to make an emotional expression of them, and the results of this techniques will entail the formulation of ideas and questions and a detailed observation too.

INTRODUCTION

Natural Sciences are a branch of the Science field that classifies and deals with the physical world as can be Physics, Geology, Biology, or Chemistry. They are some of the most important contents that a person needs to know about during her scholar life and trajectory as it is the discipline that makes the understanding of the world easier and essential. Although Natural Sciences are a very important matter to be taught in our educational system, they don't have the importance they really deserve and this sets out an impediment as it creates problems and difficulties in the student like, for example, the level of requirements the contents and concepts have.

It is here when the importance of teaching sciences in early ages appears, so, for it to not become a difficult field of knowledge, it must be made an approach to children into this discipline by providing an environment where they can experiment and have the opportunity to investigate on their own by asking themselves questions.

Throughout this work, it is going to be proposed a way of approaching this field of knowledge in a fun and ludic way, in which children can develop many skills while learning Science. What is also pretended to be done within this project is developing that sense of wonder a child has innately, by teaching in an indirect and non-didactic way, using their senses and by making them enough curious to ask things themselves.

“Any proposal of experimenting, which is preceded by a cared motivation, it is going to be well received by these fearless investigators” (Vega, 2011, p. 16-19). The objectives of teaching science must be achievable (Coll Salvador, 1987) and must develop, among others, cognitive, interpersonal, and social human capacities. So, they do not have to be centred in cognitive aspects, but in other varied leanings and their development.

I. Justification

“The contents that are going to be addressed in Pre-primary Education are going to be organized in different areas that correspond to different fields of experience and childhood development, so they can facilitate the discovery of physical and social characteristics of the world that live in”. (Ley Orgánica de Educación, 3/2006)

“The consciousness of the environment through activities and working methods that are based on experiences and games, will be applied in an affectivity and confidence environment to enhance their self-esteem and social integration (Ley Orgánica de Educación, 3/2006).”

World can be understood and explained from Science, so as soon as possible that we start knowing it, we are going to learn better how to interact with it, so it is better to make the initiation in the child's relationship with the Science by giving them the opportunity to do so through the experiments proposed here, which will provide them this feeling of wonder which, as it has been said before, will lead them to ask questions and let themselves be carried away by curiosity. There is a social tendency to underestimate knowledge provided by those different fields it is divided in, making sciences being isolated from the other subjects and restricting the possibilities of learning that are related between them.

All the work presented here and the way it is done is due to previous experiences, which are wanted to be shared with the children so that they experience the same thing, as well as to provide them with indirect knowledge about science and make them understand that science can be entertaining and not give them any reason to believe in the future that it is useless, but quite the opposite. It is through the creation and development of a critical spirit in children that the objectives set out in this project will be most successfully achieved.

II. Objectives of this project

On the top of these objectives, the main one proposed for the project in itself is to develop an intervention proposal to improve the educational practice by introducing them into experimenting and scientific methodologies.

The other objectives that are pretended to be reached with the methodology of the project are the following ones: to develop in the students the innate sense of Wonder they have, and to stimulate the feeling of asking questions to make discoveries, not only about the field of sciences but everything that is surrounding them; secondly, to make them develop a critical spirit and relate it with the sense of wonder that they already have for creating in them a perception and an ability to analyse and put in order the perception

they acquire from the rest of the world. Finally, the last objective is to approach Sciences and their experimentation to children in early ages.

THEORETICAL FRAME

The environment is the main thing that surrounds the human being. Absolutely everything is related to nature and all that is related to it, including all the people themselves.

Nature has the potential to wonder us, in all the possible ways that we can imagine, as it is the most important way to fully develop our intellect and moral. One person that acquired experience and knowledge about the sense of wonder the nature can rouse in children was Rachel Carson (1956), who explained in her article “*Help your child to wonder*”, which lately became a really explicative book that has been making important references until nowadays. “Wonder” means to get amazed by something, great admiration, or strangeness, deriving in making the person to ask herself about something that is new, in developing an intrinsic thinking.

In her article, Carson makes clear the importance of introducing since early ages our children into nature, not in an academic perspective but in a simply connective one, to establish a relationship between the child and the adult, and in where both parts can share ideas, perspectives and philosophic overtones coming from the elementary things. The relationship that is going to be established must be of sharing, thoughts in the majority of it, not knowledge. By letting our child discover nature we must let her explore, ask, etc. by accompanying him during the process. Also, the place to be indirectly taught in this way, must be presented to the child in different ways, no matter if it rains or the sun burns your forehead; no matter if the darkness of the night appears to eat you or the day is as long as making a round through the whole Earth avoiding the moon to appear behind you.

In addition, the importance of the approach of a child into nature is also reflected in the *Real Decreto 95/2022, de 1 de febrero*. Area 2 is related to discovering and exploration of the environment, and the point to make with this field is to give an improvement and introduce children in the discovering, observation, and exploration of all the physic and natural elements of the environment that surrounds the child and using it as a tool to provoke on them different emotions and surprises.

The specific competences are oriented to the development of the child’s thinking and the different cognitive strategies the child’s brain uses to understand the environment. What makes a relationship with Carson’s article and the pre-primary curricula is that the

best way to provide the child these strategies and curiosity is by stimulating in all the possible active and ludic ways, experimenting, and making oneself questions. Why when the child puts herself in the sun, starts to feel hotter, why can the child see colours and how are they “created”, or why when she goes to the beach, can see the waves of the sea come to the land and then go back during all the time. These questions are also based on the reality in where human beings live in, and all are formulated basing on the idea that these experimental experiences are created because the child is exposed physically with the environment.

Once all these experiences are integrated in the school, with the project of the “Science Week”, the main objective to achieve is going to be improving the curiosity of children by making questions not only to themselves, to the rest of the class, and discover what kind of answers they provide to each question, no matter if they are the real ones or imaginative and creative ones. This is going to be produced, all of it, by experiments that they are going to do with different materials available around them and by feeling sensations of what wonder cause in them.

Catherine L’ecuyer (2012) in her work “*The Wonder Approach*” must also be highlighted within this theoretical frame. The importance of the daily-life opportunities children are in themselves, to make adults be wondered about the world in the same way that the little ones do. Learning becomes meaningful for the child when the sense of wonder is combined with beauty through sensitivity and a secure attachment that the child has for the adult that must accompany her through all the way of exploring the world.

Finally, as experiments are like problems that need to be solved while they contribute to the learning of a determined thing, Vygotsky refers to the Zone of Proximal Development (ZPD) as the “distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). So, the more social interaction with their environment, the more knowledge the learners will acquire about it. This means that the child develops the ability of learning while she is situated in this zone between what is known and what is not. And it is going to be completely achieved accompanied with an adult, who makes the guidance or encouragement as a knowledgeable person.

Significant learning is included inside the constructivist perspective, where the construction of learning and knowledge is considered, and this will lead children to connect different new learning and knowledges with the ones that they already have. The knowledge patterns relate again to make a cognitive restructuring, that makes an imbalance between the previous knowledge and the latest ones, so automatically, in the brain are launched some regulation mechanisms that restore that balance and producing learning as it is (Trilla, 2001)

Science Didactics has its main fundamental theory on reflexion (Perales y Cañal, 2000), so the best way to introduce it to children is by scientific experiences that could allow them to create and think about hypotheses and reflecting on the results.

As it has been said that experimentation is going to be the basis of this programming project, it is important to specify what is this experimentation process in itself. Experimentation is the process of entail a scientific investigation to achieve a hypothesis and test it to get an answer. Involves the process of planification and carry out a series of procedures, measurements, and observations to collect different kinds of data and draw conclusions about a particular phenomenon. Experimentation is a fundamental methodology in science, from which human being acquires knowledge and understand the natural world.

I. Why is it important to teach Sciences during this Pre-Primary stage?

According to Caravaca (2010), making a basic approach to scientific knowledge can set up a solid base for those future knowledges the child is going to acquire and to supply to her expectations to make the activities funnier and more enjoyable.

II. Objectives of the experimentation methodology

Using experimentation as a methodology can have several objectives for children including encouraging curiosity and exploration because it can help children learn by doing things, and encourage them to ask questions by exploring the world around them; by giving the children the opportunity to experiment and explore they are going to develop critical thinking skills, as experimentation requires children to make observations, ask questions, and draw conclusions based on evidence. This can help them

develop their critical thinking skills and learn to approach problems in a logical and systematic way in all the daily life situations.

Also, children are going to build problem-solving skills since experimentation often involves the identification of a problem, the development of a hypothesis and testing different solutions, so they can also apply it in many different areas of life. Fostering creativity encourages children to think outside the box and come up with innovative solutions that nobody has reached before. Finally, by experimenting, they will build a scientific knowledge, about scientific concepts, and principles in a hands-on way, making it more engaging and memorable than traditional classroom instructions.

METHODOLOGY

A methodology is a system of procedures that uses different techniques and strategies that, depending on whether it is carried out, are going to contribute to make optime the acquisition of new knowledge and abilities. The strategies to be done in here are going to be the experiments along the whole week.

With this project, in addition to from everything that has already been exposed, there are some other educational aspects that are worked with this didactic programming. A didactic programming is the specific tool of planification, development and evaluation in each area, and in where will be some objectives, contents and elements that compose it.

In this section, the organization of the project will be explained in detail, including aspects such as the role of the teacher, the evaluation to be carried out, the development of the experiments or the contents that will be worked on in this area of knowledge of the environment among others.

I. Organization and development of the project

The organization, as it has been explained before, will follow the structure described on figure 1 (annexes). During the previous days of the development of the project, there will be some activities to make the designment of the posters announcing the *Science Week* and making promotion around the school. The organization of the project is going to be described henceforth:

During the week before the development of the project, the organization of the school will be proceeded in sending school circulars to the parents or tutors of the children to make them conscious of the project and having some resources that are going to be needed in the science week. Also, there is going to be a promotion campaign around the school in which are going to participate other classes from primary education by making posters (Annexes, figure 3) announcing the science week and that is going to involve them also if they have siblings in pre-primary education.

After all the previous work done, the organization of the *Science week* in itself is going to be done with an introduction to the children in an assembly based on the question

of “What is science?”. Because of the importance of making children ask themselves things and having them to answer it, the teacher is going to be limited to be a mediator in the assembly and to maintain the order of children talking.

On the first day of the project and after having an assembly all together with the teacher, they are going to make two experiments: *Flowers that change their colour* and *The jumping egg*. The second day of the week the children are going to make three experiments based on colours (*The Newton's disc*), the creation of the elements in nature (*The snowy tree*) and the last one in the day, based on the life cycle of a plant (*Plant your own seed*). The next day, all the children are going to be introduced to a very newly tool called *The merge cube*. This cube is related to new technologies and a new way of learning that has been shown as a very useful thing to make with children as they are really into modern ways of learning. During the fourth day of the Science week, the experiments children are going to make are *The discovery of density between water and olive oil* and *The power of soap*, which can be also taught in a way of developing hygiene habits in children. And for the last day, they are going to see *The liquid rainbow* and *Light's refraction*.

Before finishing the day, the teacher is going to make the last assembly of the project by talking with the children what they have worked on and what they know, experiment by experiment, and ending with a main question that could be “Did you feel surprised when you see what happened in each experiment?”. The assembly is going to be done to make them propose the rest of the class what they felt, what they think about the experiments and if they understand what science and how many things the concept is.

1. Target children for this project

The activities proposed can be adapted according to the age of the children, but it is mostly directed and planned for children that are in an age range between 4-5 years old. The project will consist of the development of 10 experiments and the corresponding monitorization and evaluation of them, according to the pupil and through the observation and the establishment of different objectives designed according to the activity and the objectives proposed by the legal framework surrounding this work.

2. Context, population, and sample

Velilla de San Antonio is a village in Madrid's Community partially located in the Southeast Regional Park in Madrid, which runs around the Manzanares and Jarama Rivers. Within the municipal boundaries of the village, there is established a set of habitats that give a great variety and uniqueness to the landscape and, together with the 4 lagoons that make up the park, it can be highlighted the great presence of aquatic birds. Since 2004 it is recognised by UNICEF as a "Child-friendly city".

The village has a population that goes around the 12.700 citizens, and is provided by 4 nursery schools, 2 Elementary public Schools (C.E.I.P Francisco Tomás y Valiente and C.E.I.P. Valdemera) and 1 High School (I.E.S Ana María Matute). But the organization and development of this project will be developed in the Pre-Primary stage on C.E.I.P Francisco Tomás y Valiente.

The school has 2 classrooms of 4-years-old, and each of them are composed of 16 children, and the sample of the project will be one of them, which ages are around 4/5 years old. In the project will participate both classrooms, and the evaluation will be done for all the students and done by each teacher, as they have shown an equal level of learning. There is not any child with special educative needs, but only 2 students that need reinforcement around language and that are in a treatment by seeing a speech therapist.

II. Contents

This proposal intends to work on all the curricula contents, but it is specialized on developing the areas about environment knowledge. To achieve all the objectives established in the project, the contents to be addressed are described below.

Classified in procedural contents, we will include the knowledge of the life cycle of a plant and how to take care of them, what they need to live, the photosynthesis process...; observation and comparison of different densities in different liquid substances; what is a chemical reaction; the introduction of new technologies in learning Science; atmospheric phenomena and what tools you can use for measure them; what is a water molecule; and how light is formed and the refraction of it.

Apart from these contents, inside the procedural ones and more specific to what they are going to do in the experiments, it is included the acquisition of a more formal

vocabulary according to the living experiences and Science; the elaboration of series, logical sequences, their results and conclusions; and the knowledge of the Environment.

Other classification of contents will be attitudinal contents that will be worked on a base of rules and from the experimentation process. Those contents will include curiosity and sense of wonder and comprehend; cooperation; understand and follow the teacher's instructions in the experiments; and respect speaking times between some others.

III. Data collection tools

The two data collection tools used in this project have been decided as direct observation, made by the teacher by all what happens around the experiments and debates made by children and where she has to be the mediator; and log tables, that will be used to record the progress of the objectives of the proposal and the experiments, and they will have different items that will be rated if the objective has been achieved (A), if they are in progress (I.P) or if they are not achieved (N.A).

IV. Evaluation criteria.

The early ages, the evaluation it is used to make educational decisions, and observe the process and evolution of the students, to modify different relationships, activities and situations inside the classroom, and to analyse the educational activity of the teacher. The evaluation will have three different stages: before the project, during the project, and after finishing it.

In this case, as what has been established on the *Decreto 36/2022*, there are some specific competences established to be achieved on the second cycle of Pre-primary education in "Discovery and exploration of the environment". Those competences are to identify the characteristics of materials and objects and establish relationships between them by doing an exploration and sensory manipulation; developing scientific method's procedures by the observation and manipulation of objects to initiate themselves in the interpretation of events happening in the environment; and the recognition of elements and natural phenomena and show interests by all the things that happen in it, so they

develop a logical consciousness about the importance of taking care of the natural environment.

Inside these three specific competences, there are different evaluation criteria that expand all the knowledge a child must acquire according to this area of development. There are a lot of points to be developed in here but in here, it will be dealt only with the most important ones. The criteria related to this area and for the first competence are to establish different relationships between objects from their characteristics and or attributes, showing curiosity or interest; to use the most significant basic quantifiers in the context of the game and in relations with others; to organise the activity by ordering sequences and using basic time concepts; and learn how to use basic notions of time to investigate the passage of time and to discover some events of the past.

In addition, the criteria for the second competence are to manage situations, difficulties, challenges, or problems by the planification of activities sequencies, manifesting interest and working with the colleagues; learn how to collect ideas about the behaviour of certain elements or materials, testing them by manipulation and action on them; and participate in projects using group dynamics, sharing, and valuing their own and other people's opinions, expressing personal conclusions for them.

Finally, for the third and last criteria are to show an attitude of respect, care and protection towards the natural environment and animals, identifying the impact of human actions on them; and finally, to establish relations between the natural and social environment from the knowledge and observation of some natural phenomena and the heritage elements present in the physical environment.

V. Objectives to be evaluated in the proposal:

There will be some objectives that are common for the whole project, that are also related to the legal curricula about what is established to be the contents taught in pre-primary education.

For instance, to facilitate cognitive, motor, personal and social learning between the infants; to know better the world by reflexion and experimentation; to promote Sciences in early ages; to develop their logical thinking by debating, comprehension,

curiosity and sense of wonder; to develop in them the Scientific Method; and finally, to establish different relationships with other people that surrounds them.

1. Skills and abilities

The project *Science Week* will provide children with the opportunity and tools that are necessary in their basic needs and according to the different areas of learning such as:

Starting with the communication area, being able to acquire new vocabulary related to Science, to be able to give a reasonable scientific explanation to different successes and events, and to comprehend different knowledges that are not common to be provided in this educational stage. In the knowledge of the environment, to show curiosity and wonder about events happening in the nature or their surroundings, and to develop an environmental consciousness that will help them on their coming years.

Next, in the logico-mathematical thinking area, the skills to be acquired are to learn to use a sequence, comprehend what is a measure and apply the knowledge to different aspects of the project or daily life, and understand and know what a property of an object or a substance is and how this affects in different ways or other learnings.

In the area of learning to learn, the child will be provided with that sense of wonder that has been told during the whole project, and the exploration and being curious feelings; and last but not least, in the area of personal autonomy, children will be provided with knowledge and instrumental abilities that will able them to be more independent and autonomous.

In addition, the evaluation itself for the project will be global, formative and continuous along all the project, in where previous knowledge of children will be evaluated too. During all the project and its practice, all the experiments, knowledge, contents and objectives of them will be evaluated continuously, included those objectives established for the project. All data will be acquired by observation and annotations, to compliment the different charts.

VI. Role of the teacher

The role that the teacher has during the project should be the organization of the project, and to accompany the child in the process of discovery, providing knowledge that can be useful to the child but without explanations. In addition, she should mediate in the discussion that takes place between the children and in the questions that they ask each other so that they respect each other's turn to speak.

The teacher must also facilitate the relationship of adult-children interests and vice versa, requiring not only self-confidence, but also confidence in pupils' prior knowledge, which will gradually increase.

VII. Resources

1. Temporalization.

The time used to develop the project is going to be three weeks, in which the first one is the week to promote the Science Week around the school and sending circulars to the parents to inform them and to ask for those materials needed for the children and from them and give some time to prepare and organize to those who need it (Annexes, figure 4).

Then, the following two weeks will be the whole development of the Science Week, with one experiment per day and the previous and posterior debate with the students, addressing one hour per day.

2. Materials.

Most of the materials used in this project will be acquired by recycling and reusing other previous objects, such as glasses, yoghurt containers, bottles, pots, cardboards, etc. Some of them will be provided in the class, such as scissors, water or colours; and other materials like colorants, oil, vinegar, bicarbonate, or fire will be only provided by the teacher, and they will be used with the appropriate security measures.

3. Division of the class

The class will be working into two different groupings:

The first one is all together. All the children will work on the assembly, together with the teacher for making the proper debates before and after the experiments. This will be done in this way for them to participate in front of others, to develop the ability to express themselves no mattering if they are going to be judged or not, to understand different points of view and to acquire the notion of respecting each other's word turn.

Also, they will work by groups as the division inside the class is done in this way, but they will develop the ability to work individually, so each child can have the opportunity to make their own experimentation and manipulation of the materials.

EXPERIMENTS

I. Experiment 1: Flowers that change its colour.

In this experiment, children will be provided with an explanation of how a plant absorb nutrients, they will know the different parts of the plants, learn how to take care of a plant and the photosynthesis process.

The materials they are going to need are some jars filled with water, white flowers, different food colouring, and some scissors or a knife, which will be used by the supervision of an adult, in this case the responsible teacher. The duration of the experiment will be around 15 minutes with 15 minutes of debate of what can happen and explanation, about of different parts of the plant, and how they can take care of a plant in case they acquire one or have them at home.

The process is simple as children are going to be provided with 4 different jars, in which they will put different colours on each of them. Then, they will cut the end of the flower stems with two cuts, dividing it into 4 parts so the flower can absorb water better. Each child will introduce each part of the stem in each jar, and after 3 or 4 days, they can see how the flower is absorbing the colours.

On the assembly previously done to the experiment, the teacher will ask different questions to evaluate and see what kind of knowledge the children have about plants, like if they know what a petal is, what functions the flowers have in the nature, etc...

After the end of the experiment, they will talk about hypothesis of what can happen if the flower is submerged in different waters, and they will also learn new words like the parts of a plant, so they become more familiar with new vocabulary. They will also learn what photosynthesis is, and how this process is used by plants in order to transform energy coming from the sun, water and soil substances to live, and, the teacher can also provide information about how plants are really necessary for our lives, as the photosynthesis process also produces energy that is necessary for human beings.

The evaluation of the objectives and contents of this experiment will be analysed by direct observation made from the teacher, and writing different observations, so the teacher can complete a table which she can complete after finishing the experiment.

OBJECTIVES	A	I.P.	N.A.
Understands the concept of nutrition of a plant.			
Learns the different parts of the flower.			
Learns how to take care of a plant.			
Knows how to follow instructions while doing the experiment.			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and curiosity about the experiment.			
Participates actively on the previous debate and further discussion.			
Makes a good use of the materials			
Develops a sense of wonder.			

II. Experiment 2: The jumping egg

In this second experiment, the objectives proposed for children to be learned, will be to understand the concept of a chemical reaction, and learn that objects are conformed by substances and how these substances react to each other.

The materials that they will need are a clear container to see the development of the chemical reaction, an egg and vinegar. The duration of this experiment is around 10 minutes and 20 minutes of debate and explanation.

For this experiment, in a clear container the child is going to put an egg and pour some vinegar until the egg is completely drown. The process of doing it is short, and since the very first moment, children can observe how the shell is starting to decompose. But, until 48 hours they could not observe the real jumping effect of the egg.

OBJECTIVES	A	I.P.	N.A.
Understands the concept of substance.			
Understand the concept of chemical reaction.			
Comprehends that the whole world is composed by different substances.			
Knows how to follow instructions on the activity.			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and curiosity about the experiment.			
Participates actively on the previous debate and further discussion			
Makes a good use of the materials			
Develops a good sense of wonder.			

III. Experiment 3: Newton's disc.

For this third experiment, some objectives have been established such as understanding the composition of colours, to learn that light is composed by different colours and know more about Isaac Newton, his inventor.

So that experiment is developed, the materials needed are a white paper, colour pencils or gouache paints (red, orange, yellow, green, cyan, blue, and purple), a circular piece of cardboard, scissors, something that has circular form, a ruler, a piece of thread or a pencil to turn it around, and glue.

First, the teacher will evaluate the students' knowledge asking things like if they know what is light, or how a rainbow is created. Then, the experiment will be introduced by talking about Isaac Newton. Then, children will be provided with a white paper with a big circle in it, divided seven different areas, that they will colour in order to make a circular rainbow. Next, when they finish (in case they have coloured with pencils) or when the paint is dry, they have to cut the circle and stick it on a piece of cardboard. They will have to cut again around the circle, and with the teacher's help, they must make a hole in the centre of the disc to introduce a piece of thread or a pencil in it. When they finish all these steps, they are going to make the circle spin.

When all they have finished, they will be reunited on the assembly with the teacher, and they must explain what they have seen spinning the Newton's disc. When children have acquired an approximated answer, the teacher has to explain what is the phenomenon that has happened, making an explanation about that light is composed by colours.

OBJECTIVES	A	I.P.	N.A.
Understands the contents proposed in the experiment.			
Shows interest on learning new things like who is Isaac Newton.			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and curiosity about what happens in the experiment.			
Participates actively on the previous debate and further discussion.			
Makes a good use of materials.			
Develops a sense of wonder.			

IV. Experiment 4: blow a candle from the distance.

The objectives established for this experiment can be classified into two bigger ones like understanding the concept of a chemical reaction and know that our world and environment have also a component that are gases, that we cannot see them, but are there.

The materials needed for this one experiment are easier to get, but more dangerous than in previous ones, so that is the main reason for this experiment to be done in the assembly, after the precious debate and explanations provided by the teacher, and for the children to do it with her supervising everything and even making use of a particular material, since it requires the use of fire. The ones needed are 4 candles, 1 jar or glass, vinegar and bicarbonate.

For this experiment, children can mix in the jar or the glass, some spoons of bicarbonate with the vinegar. The teacher will turn on the candles, and one student could come out, to pick up the jar and approach it to the candles as they try to pour it out but without doing so. The gases, approximating to the candles, will turn them off immediately. The duration can be around 10/15 minutes and 20 minutes of debate and explanation.

OBJECTIVES	A	I.P.	N.A.
Understands the concept of nutrition of a plant.			
Learns the different parts of the flower.			
Learns how to take care of a plant.			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			

V. **Experiment 5: grow your own seed.**

This is a very common experiment, but it is very useful to teach children how the life cycle of plants happens, understand how they grow, the photosynthesis process they make and why are plants so important for human beings; and it is also one of the most amazing things they can observe and made by themselves, feeling like they are life creators.

The contents they are going to learn are: the life cycle of a plant, how they grow, how to plant them, what they need for them to grow, how to take care of them...; they will work on their fine motor skills; they will establish measurements and comparisons about how plants can grow and develop; and finally, they will learn about what benefits a plant has in our lives. This experiment is also really important on developing the competence of children about taking conscious about how to take care of our environment and why plants are so important in our world.

The materials needed for this experiment are cotton, water, soil, and clear containers. The space used will be the classroom, and the time will be around 20 minutes of the development of the experiment itself and 10 minutes of debate by means of the results of the experiment, which will be noticeable after the week has passed. That is the reason of making this experiment the first one of the *Science Week*.

The development of the experiment is the following one:

In the previous assembly, the activity will be presented to the students, by asking questions about if they know what a seed is, if they know what they do to grow, etc... Then, they will start the experiment: each child will have a clear container (a plastic one made by recycling a yogurt cup can be perfect), some cotton and a seed (some lentils, a bean, a chickpea...). They will wet the cotton with water and put it in the container, and then they must to introduce the seeds they have chosen. With some soil provided by the teacher, they will fill the container a little bit, maybe until the half of it, and then, with some water, make it wet. When they have finished, they will put the containers next to a window, so the seeds receive sunlight and could grow properly. During the week, they have to moisten the soil, and see what is happening: if their seeds grow or not, analyse what happens and why, etc...

As the project is developed in two weeks, the assembly of debating what happens in this experiment will be done some days after they have made all the process. In this assembly, the teacher will ask them what they needed to make the seed grow, what the plant needs to grow up and develop, how is the photosynthesis process made and what this supposes to human beings...

OBJECTIVES	A	I.P.	N.A.
Knows how to take care of a plant.			
Shows a responsible attitude towards the plant to make it grow.			
Understands the process of photosynthesis and what this causes and benefits human beings.			
Understands the importance of plants.			
Develops a consciousness of recycling and reusing things.			
Develops a consciousness of taking care of our environment.			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			

VI. Experiment 6: the Merge Cube.

The following experiment is not really so. Merge cube is a technological tool that allows students a new way of learning and to interact with the digital world and virtual reality, so they can explore it because they have it in their hands. It is a new way to introduce Science in all its fields to students, by using 3D technology and much more. Merge cube works with Merge Edu, which is a platform that helps children to learn Science in a more effective way, by touching it and interact with it. Due to all the technological changes that are happening nowadays, it is a good way to work with children something that they can show a lot of interest in.

It can be used at home and in the classroom, just by downloading some educational applications that are designed exclusively for this practical learning. Not only it allows a multisensorial learning but enables a development of spatial abilities as well. Merge cube provides the student to interact with the digital content in an intuitive and natural way by using the visual, hearing, kinesthesia, and tactile senses to give a more memorable learning experience. Also, thanks to the 3D technology, the students can develop their spatial intelligence by manipulating the cube and the objects it projects.



Figure 1: The Merge Cube. Own elaboration.

It is true that this tool is going to be presented as something new for these students, and it can also be used on other contents and moments of the scholar year, always in a moderate use and taking into account that children can develop an “addiction” to it, so it can be also proposed as something to use when they behave pretty well, or maybe from time to time. As Science also includes technology as one of its fields, it is a good moment to present this kind of educational tools to them.

Therefore, lots of contents can be taught with this Merge Cube

(animals, the terrestrial layers, the exploration of fossils...) and the teacher can choose one topic to show to the students.

The objectives proposed for this experiment are to understand Science in another different way that the traditional one, to introduce new technologies to the students, provide a development of spatial intelligence, and the development of multisensorial learning.

The session can be divided into 30 minutes of manipulation by the students of the cube, and a debate of 30 minutes related to the topic chosen and taught with this tool.

OBJECTIVES	A	I.P.	N.A.
Develops the spatial intelligence.			
Shows interest on a new way of learning.			
Develops the spatial intelligence by using the Merge Cube			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			



Figure 2: Functioning of the Merge Cube. Photo by María Howard.

VII. Experiment 7: elements' density.

This experiment is quite simple and easy to do for children, but it has also a lot of information that can make children understand how the world that surround them works. The objectives established for the following experiment are to explain what an element is, to know what properties are and that elements have them and to understand that different elements have different densities. The materials needed in here are a clear bottle or jar, water, olive oil and alcohol, which will be managed most of the time by the teacher. They will be divided into groups, and the time used for this can be around 10 minutes of the experiment development and 20 of debating in the assembly.

In the clear jar, and with the supervision of the teacher, the students divided into groups will pour the water into it, and after it, the olive oil. They have to observe and debate into their groups what is happening. After this, the teacher will provide some alcohol to each group, and one of the students must pour it into the jar. A reaction will be caused, and they should talk about what is happening. Afterwards, they will reunite in the assembly to debate what has happened. The teacher can help by asking questions like “What could you observe when you poured the olive oil into the jar?” or “What is above: the alcohol or the water?”. Then, she will explain what density is and how this phenomenon occurs to happen.

OBJECTIVES	A	I.P.	N.A.
Understands the definition of an element.			
Understand what a property of an element is.			
Understands what is density and that different elements have different ones.			
Develops a consciousness of taking care of our environment.			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			

VIII. Experiment 8: the power of soap.

For the next experiment, the objectives proposed are to learn what properties has soap on our health, remember that water is composed by molecules that give it some properties, and learn different healthy objectives by achieving some competences and skills related to health and personal autonomy.

What are the materials needed for this activity? A soup plate, water, pepper, toilet paper and soap.

The introduction to the experiment is going to be in the assembly, proposing children to think about how they could use all those materials and what the experiment can be about. This could have a duration around 10 minutes. The development itself of the experiment will be done by them too. The teacher will propose to put water into the plate and to add pepper. She can ask them what happened: the pepper and the water have mixed? After that, she will propose two of them to introduce one finger and see what happens. The pepper will be stick in their fingers, and they should show the rest this. After that, they should clean their fingers and put a drop of soap in them. Finally, they introduce the finger again into the water and see what happens.

They will observe that, without soap, the particles of pepper will stay in their fingers, but on the other hand, when they use soap, this repels them from their fingers. This is a very good experiment to promote on children's healthy habits, by explaining them that pepper is a similarity in this case to germs. Soap is the best way to repel them, as it does it with the pepper in the water, so they can understand better the importance of cleaning well their hands. The teacher can also explain that pepper floats on water because, on the most upper layer, the molecules are stronger, so they don't able pepper to sink.

OBJECTIVES	A	I.P.	N.A.
Understands the phenomenon of pepper floating in water			
Learns about different hygiene habits to promote their health and personal autonomy.			
Remembers that water is composed by molecules.			
Knows about the three stages of water (solid, liquid and gas)			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			

IX. Experiment 9: atmospheric thermometer.

The second to last experiment has provided to the author some different objectives such as knowing about what an atmospheric phenomenon is, learn what different types of atmospheric phenomena exist and why are they caused, and understand what temperature is and that how it increases and decreases. The materials needed for this activity will be an empty plastic bottle of 50 ml, a drinking straw, plasticine, water to fill the bottle, scissors, food colouring, and a bowl filled of hot water. The time spent for this experiment will be around 20 minutes on the elaboration, and 15/20 minutes on the debate.

With the scissors and with the teacher's help, the students will make a hole on the bottle plug as big as the straw is. They must introduce the straw on the hole, close the bottle assuring the straw reaches the water and put around it some plasticine to avoid possible leakages. Afterwards, they should fill the bottle halfway and put some drops of food colouring to see the water properly. To see how the water level rises inside the straw, they have to put the bottle in a bowl full of hot water, so the water molecules start shaking and push the liquid up through the straw. On the debate, the teacher should explain this phenomenon to the students after they debate what happens when they heat up water. The teacher can also add other different concepts or kinds of knowledge like the stages of water, how to take care of water and what to do to save it and make a good use of it, etc...

OBJECTIVES	A	I.P.	N.A.
Understands what atmospheric phenomena are.			
Knows how to identify different atmospheric phenomena and why are they created.			
Comprehends what temperature is and how this can raise and increase.			
Knows about the three stages of water (solid, liquid and gas)			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			

X. Experiment 10: the magic glass.

With this final experiment, children are going to learn differently what is light's refraction and reflexion. The objectives established for this activity are to learn about light and its properties, what is an optical illusion, and what is reflexion and refraction phenomena. The materials to be used for this experiment are a glass, water, a paper with an arrow drawn in it, and a flashlight. The time used for the activity can be around 10 minutes of previous debate, 15 minutes for the development of the experiment, and 15 more minutes to debate what happened after the experiment.

For the first part of the experiment, the teacher is going to to make an assembly presenting all the materials to the students. They must make inventions about what they can be used all together and, propose and debate some ways to do the experiment. Then the teacher will explain the experiment and do it with the students. She will fill the glass with water and put down the blinds, so they can see properly the reflexion of light produced by the flashlight and put it near the glass. The second part will consist of doing the same, but with the paper with the arrow. The teacher will place the paper behind the glass and move it until the refraction phenomena of the water makes the arrow point to the other side. On the subsequent assembly, they will explain, try to understand, and talk about what happened on each part of the experiment. Then, after the debate, the teacher will explain what happens with light and which is the phenomenon they have seen in each part. She can also explain what an optical illusion is.

OBJECTIVES	A	I.P.	N.A.
Understand what refraction and reflexion phenomena are.			
Understands the properties water could have.			
Comprehends what is an optical illusion.			
Knows about the three stages of water (solid, liquid and gas)			
Knows how to follow instructions while doing the experiment			
Develops a logical reasoning about what can happen in the experiment.			
Shows interest and participates on the debate.			
Makes a good use of the materials.			
Develops a sense of wonder.			

CONCLUSIONS

To end this project, it is important to highlight again the importance of this method and learning project has its main objective on satisfying different needs of children by promoting an active learning that is based on creativity, experimentation, and manipulation, and that will promote the development of that sense of wonder that has been mentioned through all the work.

From the moment that children experiment these practices and develop that Sense of Wonder and curiosity, learning becomes a much simpler and accessible process for their early age group. Early ages have this main benefit: when all these contents are worked during pre-primary education, it produces a great improvement in the acquisition of other knowledge, as they are benefitted with a much higher level of logical and critical thinking due to the ease which they can absorb all the knowledge of everything that surrounds them.

The students can also learn that the activities and work they do inside the school can also be used in other life aspects, and they understand that everything they learn at school is related to their own reality, that it is not a different world apart from the other one they see when they are at home with their families. It is in these ages that they comprehend the experiences can provide them different ways of learning, but they are going to achieve the same conclusion: the world where they live is only one, no matter if they are in the school or not, and reality is for everyone the same.

So, the methodology that has been suggested, and subsequently used, has been effective to teach children the different contents, competences and to achieve the objectives of the project and those ones established in each experiment. Their curiosity and sense of wonder has been awakened, and they have been motivated enough to find new sensations, information and to correlate social and natural environments, so the achievement of significant learning with the experimental method works perfectly in these scholar years. Nonetheless, some limitations have been found in the development of the project, can be summed up in the conversational times during the assemblies. One limitation that has been found is that, during these spaces, was that the unique students that carried out the interrogatives proposed by the teacher or maybe by themselves, were only answered by the same ones because of their easy way of speaking or because they are less shy than the others.

As the results doing the activity have been better than expected, and the objectives were completely achieved, it encourages the development of this activity into other previous and posterior years like making the activity more complex for the 5-year-old ones and a little bit more easier for the 3-years-old, because they can also find different results in the process of doing the project, but always trying to find the sense of wonder that is intended to be pursued throughout the whole programme.

It has also been analysed and observed the intention of making this programme for other cycles and stages, as it can also be developed in more weeks with more activities or including the development of the experiments in pre-primary education that require the participation of families to develop the relationships between them and the school and providing a sensitization of the scientific environment within the school.

Finally, it has also been considered that all the activities can be improved, so maintaining a positive attitude towards new ideas that could be given by colleagues, professionals, different workgroups, etc... will be also the best thing to give the students their best learning experience, one that they could remember forever.

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ANNEXES

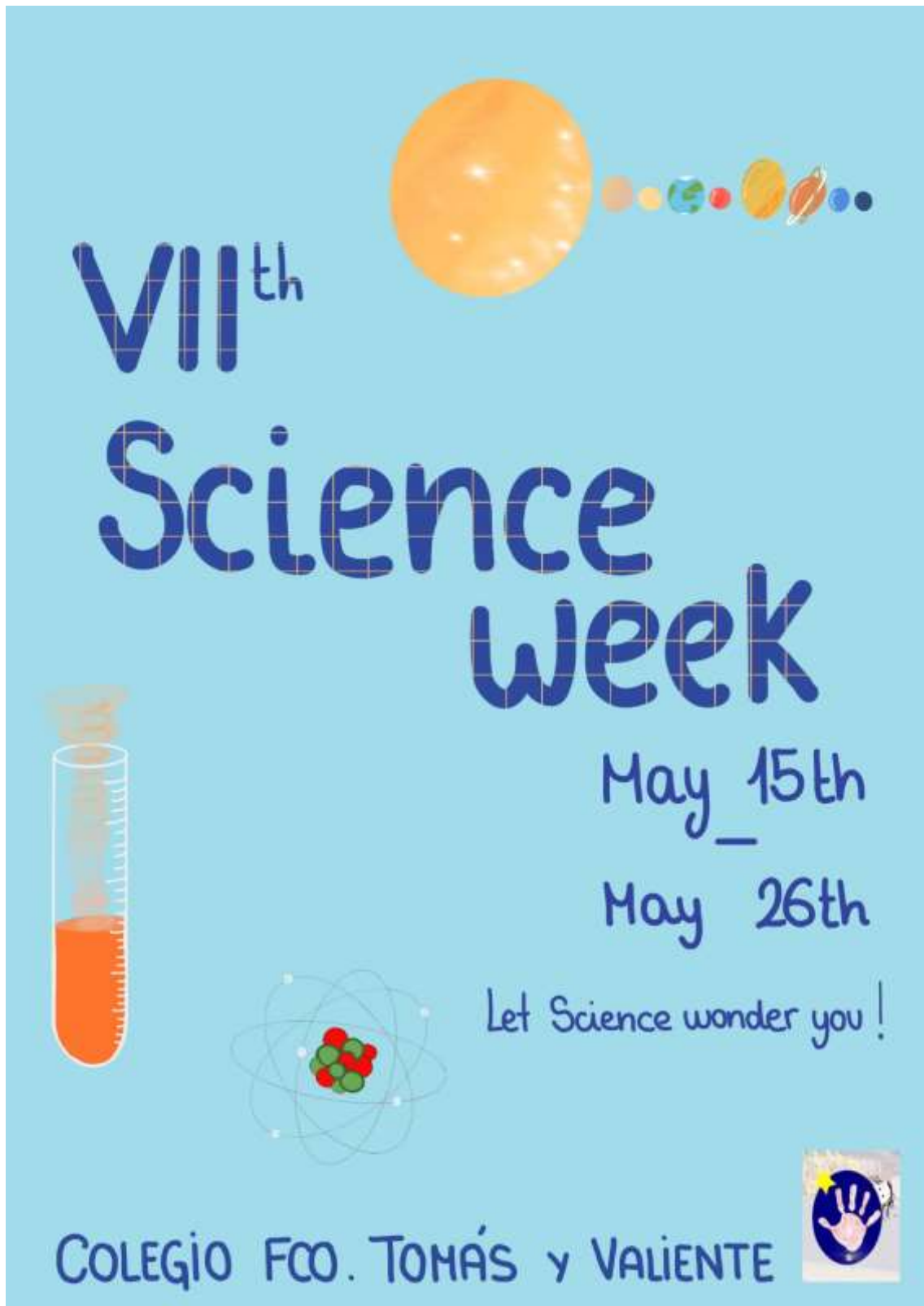


Figure 3: Example of a poster for the announcement of "Science Week". Own elaboration



Figure 4: example of schedule developing the sessions. Own elaboration