

# Degree IN TEACHER OF PRIMARY EDUCATION

## Subject: Science Education

### Course: 2019-20

#### Chapter 2. Selection and sequence of contents.

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#### 1. Fundamental concepts.

An Overview of a Primary Science Curriculum brings us to the most general and fundamental concepts. Main examples of these fundamental concepts are such as Diversity, Cycles, Systems, Interactions, Energy and Matter. The complexity of the teacher's explanations has to attend the specific needs of the different levels of students.

Example: If we divide the primary education period into two blocks: 7-9 and 10-12, the younger students should be introduced to these concepts through different levels of complexity in the content.

CONCEPTS			
	Diversity	Cycles	Systems
Block (7-9)	<ul style="list-style-type: none"> <li>Diversity of living and non-living things (General characteristics and classification)</li> <li>Diversity of materials</li> </ul>	<ul style="list-style-type: none"> <li>Cycles in plants and animals (Life cycles)</li> <li>Cycles in water (Matter cycles)</li> </ul>	<ul style="list-style-type: none"> <li>Plant system (Plant parts and functions)</li> <li>Human system (Digestive system)</li> </ul>
Block (10-12)	<ul style="list-style-type: none"> <li>Diversity of human beings</li> <li>Diversity of materials (General characteristics and classification)</li> </ul>	<ul style="list-style-type: none"> <li>Cycles in plants and animals (Reproduction)</li> <li>Cycles in matter and water</li> </ul>	<ul style="list-style-type: none"> <li>Plant systems (Respiratory and circulatory systems)</li> <li>Human systems (Respiratory and circulatory systems)</li> <li>Electrical system</li> </ul>

CONCEPTS		
	Interactions	Energy
Block (7-9)	<ul style="list-style-type: none"> <li>Interaction of forces (Magnets)</li> </ul>	<ul style="list-style-type: none"> <li>Energy forms and uses (Light and heat)</li> </ul>
Block (10-12)	<ul style="list-style-type: none"> <li>Interaction of forces (Frictional force, gravitational force, force in springs)</li> <li>Interaction within the environment</li> </ul>	<ul style="list-style-type: none"> <li>Energy forms and uses</li> <li>Energy conversion</li> </ul>

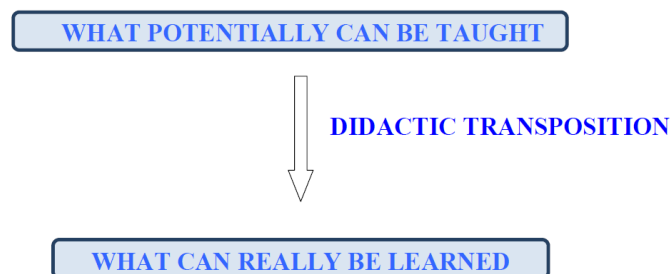
These elements take part in what we call "conceptual content" whose learning also includes: Knowledge, Understanding and Application of:

- Scientific phenomena, facts, concepts and principles
- Scientific vocabulary, terminology and conventions
- Scientific instruments and apparatus including techniques and aspects of safety
- Scientific and technological applications

## 2. Selection and sequences of contents.

The process of selection of school content is the '**didactic transposition**'. It does not consist solely and exclusively of simplifying scientific knowledge to make it available to students. It involves a complex process of restructuring scientific knowledge in which various factors affect, namely, the science of scientists, the characteristic of the students and the social requirements.

The didactic transposition requires necessary modifications to move from "knowledge" of scientific culture to school "knowledge". In short, it is a process in which an object to be taught becomes a teachable object.



The current legislation that regulates curricular content is:

### NORMATIVA ESTATAL

- *Real Decreto 126/2014, de 28 de febrero, por el que se establece el currículo básico de la Educación Primaria.*

- *Orden ECD/65/2015, de 21 de enero, por la que se describen las relaciones entre las competencias, los contenidos y los criterios de evaluación de la Educación Primaria, la Educación Secundaria Obligatoria y el bachillerato.*

### NORMATIVA POR COMUNIDADES AUTÓNOMAS

#### Andalucía

- *DECRETO 97/2015, de 3 de marzo, por el que se establece la ordenación y el currículo de la Educación Primaria en Andalucía.*

- *Orden 17 de marzo de 2015 por la que se desarrolla el currículo correspondiente a la educación primaria en Andalucía.*

However, one of the main questions is *how to select the contents*. From this point of view, we can establish some general criteria:

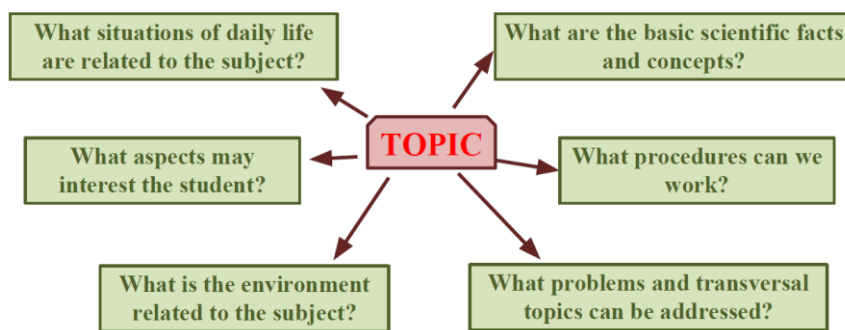
- **Fulfilling the intellectual characteristics of the students** (between 6 and 12 years old, students know and build different realities, relationships, acquire knowledge through various procedures and forms of reasoning).

- **Adapted to affective characteristics:** The contents must be functional, connect to the interests and needs of the students. Also, they must consider the emotional aspects and be useful for understanding real situations related to their daily lives.
- **Relevant culturally and socially:** The scientific contents must contain the basic concepts and procedures, and those models and theories with the highest potentiality to explain the reality, including transversal topics (Education for Health, Environmental Education, New Technologies...). Therefore, it must transcend an overly classical conception of academic knowledge and include new themes and social concerns.

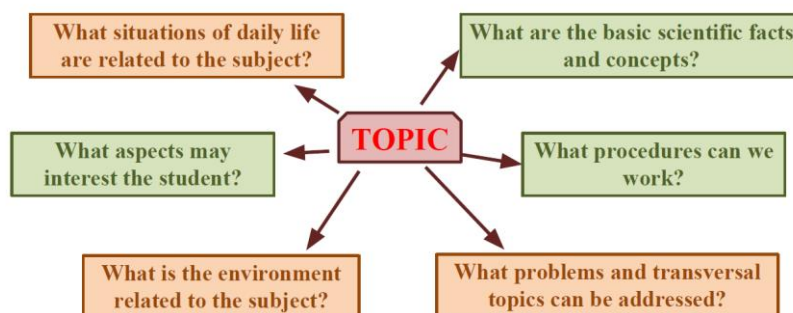
In particular, we can reflect on how to select the science contents, or, individually, what criteria will apply to choose these contents:

- Help understand everyday facts and the world around them and apply to the experience.
- Be available to students according to their intellectual maturity.
- Allow the use of procedures
- Provide the base of scientific knowledge
- Use transversal topics

Therefore, we can summarise all these criteria in the following scheme:



Currently, the teacher must consider the three most important issues surrounding a topic, following the above criteria. These issues relate to a methodology prevalent in recent years called context-based teaching (contextualization) that links the contents to real-world situations.



### Content sequencing

First, we can define sequencing as the action of ordering the activities with the pedagogical purpose of facilitating their learning by the students and adapting them to their abilities. In that sense, content sequencing gives answers to questions such as:

Can all contents be taught at the same time?

All conceptual areas can be taught from the beginning?

When should begin to teach a certain area or certain contents within an area?  
In what order? at what age??

There are some criteria established to carry out sequencing to answer these questions:

- + Start working with basic vs complex contents and those that have an instrumental carácter.
- + Begin with the knowledge of facts and descriptive concepts (first cycles) after those of more interpretative carácter.
- + First, work the contents closest to the students and then the furthest.
- + Deal first with the events that occur in at present. Then apply it to more distant experiences in time

We are going to develop these ideas on the context of four essential content strands, as examples.

### EXAMPLE 1. Living things

#### A. Selection of contents

This content focuses on plant and animal life. Major themes within it include:

- a) The wide **variety** of living organisms (animals and plants) in the local and global environments.
- b) The **life processes** in animals and humans (nutrition, movement, growth and reproduction).
- c) The **structure** and function of the principal parts of the human body as they relate to life processes

#### B. Sequences of contents

In the *7-9 classes*, children should learn to observe and identify a wide **variety** of living things among the common local plants and animals in the immediate environment of the school. Similarities and differences among these living things should be noted, and recognised as examples of different groups, for example, birds, farm animals and pets. Children should be able to identify a range of birds, mammals, trees, flowers and insects when they observe them directly. They should become aware of the differences between plants and animals. The concept of the life cycle will start to become familiar.

In the *10-12 classes*, children should group animals, according to observable features, and begin to use charts, posters, videos and simple keys to aid their identification. They also should recognise differences between individuals of the same species (including humans).

### EXAMPLE 2. The processes of life

#### A. Selection of contents

Students have to gain awareness that humans, plants and animals have properties and characteristics in common, such as movement, response to stimuli, feed, respire, grow, excrete and reproduce.

#### B. Sequences of contents

In *7-9 classes*, children should recognise that living things grow and change, through first-hand observations and experiences, such as planting seeds/bulbs and observing plants and animals in the immediate environment. They should develop the concept of the life cycle, change and growth.

In *10-12 classes*, children should be aware that living things share similar life processes but that they carry out these life processes in different ways. They will observe and develop their ideas about the human body, growth, movement, breathing, changes and reproduction. At the end of their primary school, children should have developed a simple understanding of the essential life processes of growth, feeding, breathing, excretion, reproduction, movement, and sensitivity to the environment. They will also recognise that, in the human body, each primary life process links to a system of body organs.

### **EXAMPLE 3. Environmental awareness**

#### **A. Selection of contents**

This content emphasises that children's experience of science should lead to an informed appreciation of the environments. They should develop an awareness of the interdependence of the living and non-living elements of environments and an understanding and appreciation of the positive contribution of science and technology to society. They should be encouraged to positive environmental actions, commitment to sustainable lifestyles and a sense of personal and community responsibility of the Earth.

#### **B. Sequences of contents**

In *7-9 classes*, children should develop an awareness of his/her closer natural environment, and the habitats provide for plants and animals. The teacher should allow them to act to care for the close environment, for example, by keeping the classroom tidy, the school and playground clean, and caring for plants and animals.

In *10-12 classes*, they should develop an understanding of different environments and the interdependence among systems (relationships between the plants and the animals in the environment). They will study plants and animals as elements of the whole community (ecosystem), which is composed of many other species and non-living surroundings. Children should appreciate how science and technology have enabled people to use the Earth's resources for the social, cultural and economic benefits of humanity. They should also become aware of the applications of science and technology in familiar contexts in the home, school, workplace and the environment. An essential aspect of this strand is that children should be able to explore environmental issues in a critical and informed way.

### **3. Types of contents and differences**

#### **Content's types**

Within the framework of the curriculum, it is essential to inculcate the spirit of scientific research. Three main domains integrate the implementation of scientific research: (1) Knowledge, Understanding and Application, (2) Skills and Processes and (3) Ethics and Attitudes. These domains are essential to the practice of science.

#### *1. Knowledge, Understanding and Application*

Scientific phenomena, facts, concepts and principles  
Scientific vocabulary, terminology and conventions  
Scientific instruments and apparatus including techniques and aspects of safety  
Scientific and technological applications.

## 2. Skills and Processes

The inquiry-based on knowledge, issues and questions related to the roles played by science in daily life, society and the environment. To promote an inquiry mind in the student, we have to wake their curiosity and willingness to explore the things around them.

Skills		Processes
<ul style="list-style-type: none"><li>• Observing</li><li>• Using apparatus and equipment</li><li>• Formulating hypothesis</li><li>• Generating possibilities</li></ul>	<ul style="list-style-type: none"><li>• Comparing</li><li>• Communicating</li><li>• Predicting</li><li>• Classifying</li><li>• Inferring</li><li>• Analyzing</li><li>• Evaluating</li></ul>	<ul style="list-style-type: none"><li>• Creative problem solving</li><li>• Decision-making</li><li>• Investigation</li></ul>

## 3. Ethics and Attitudes

One of the final objectives of the science curriculum is that students value science as an essential tool to help them explore their natural and physical world. Also, they must appreciate the positive contribution of science and technology to society and to apply necessary attitudes such as:

