

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

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

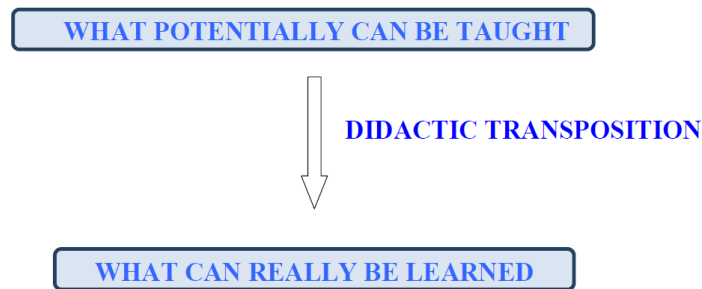
These elements take part in what we call “conceptual content” whose learning also includes: Knowledge, Understanding and Application of:

- 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 referred to as '**didactic transposition**', and does not consist solely and exclusively of simplifying scientific knowledge in order 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 has to do with the modifications of a different order that underlie the passage from the "knowledge" of culture (scientific heritage) to the "knowledge" of the school, a process in which, from an object to be taught, we make 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 for this selection of content in Primary Education:

- **Adapted to the intellectual characteristics of the students:** It means that, between 6 and 12 years, it substantially varies the realities that students can know, the type of relationships they can establish between them and the procedures they use to access knowledge. It is necessary to consider the forms of reasoning that characterise students' thinking when selecting content
- **Adapted to affective characteristics:** It means that the selected contents must be functional, connect with the interests and needs of the students, and be useful to understand real situations and related to their daily life. It is necessary to consider the affective traits of students because it affects learning.
- **Relevant culturally and socially:** It means that the scholarly scientific contents must contain the basic concepts and procedures, and those models and theories with the greatest potentiality to explain the reality. Therefore, it must transcend an overly classical conception of academic knowledge and include new themes and social concerns. In that sense, topics such as Education for Health, Environmental Education, New Technologies or Consumer and User Education, called "transversal", should be part of the teaching of all areas of the curriculum of Primary Education. It is also advisable to use the natural and cultural environment of Andalusia as a source of selection.

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

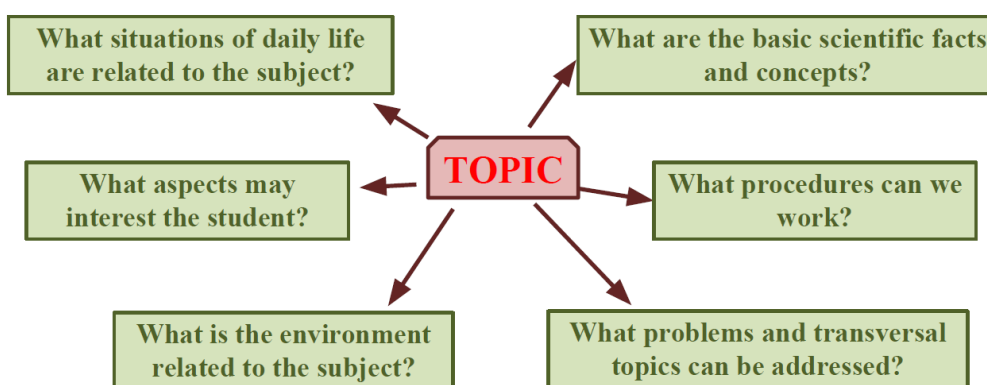
- ❖ **Help understand everyday facts and the world around them and apply to the experience.**
- ❖ **Be available to students according to their intellectual maturity**
- ❖ **Allow the use of procedures**
- ❖ **Provide the base of scientific knowledge**
- ❖ **Use transversal topics**

Two basic questions must guide us:

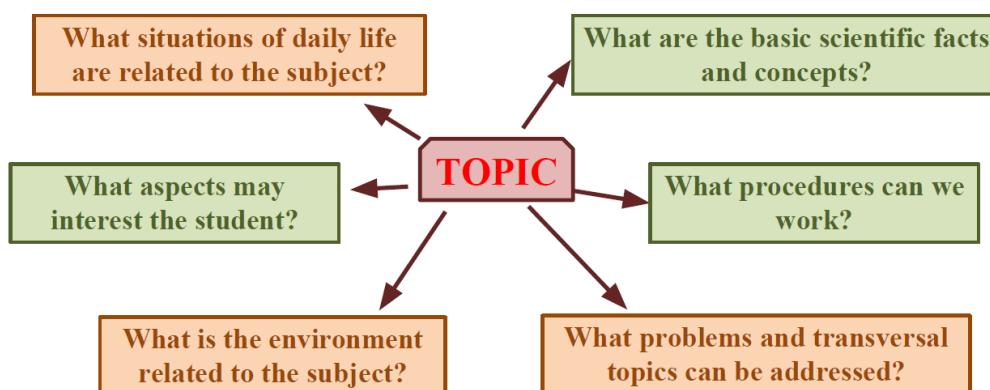
What do we consider important to teach?

What can we teach based on the intellectual characteristics of elementary students?

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

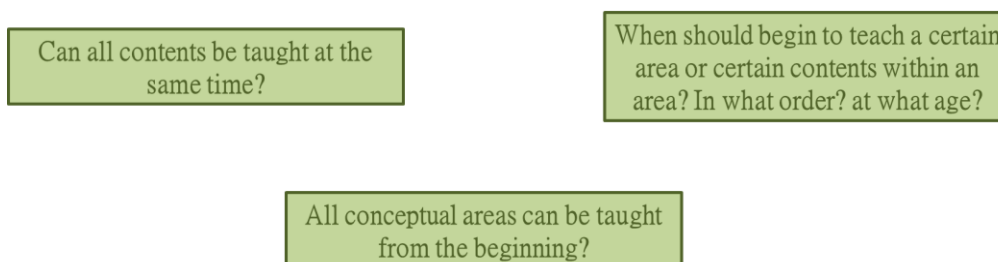


In detail, we can consider the three most important issues surrounding a given topic, following the above criteria, related to a didactic methodology prevalent in recent years called context-based teaching (contextualization). This methodology consists of a didactic approach that relates the contents with real-world situations.



Content sequencing

First, we can consider the definition of sequencing as the Action of ordering the didactic actions 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:



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.

These are:

Living things / Energy and forces / Materials / Environmental awareness

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**, including nutrition, movement, growth and reproduction, common to animals, including humans
- 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 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, through first-hand observations and experiences, such as planting seeds and bulbs and observing plants and animals in the immediate environment, should recognise that living things grow and change.

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.

By the end of their primary school, children should have developed a simple understanding of the basic life processes of growth, feeding, breathing, excretion, reproduction, movement, and sensitivity to the environment. They will also recognise that, in the human body, each main 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 awareness of his/her closer natural environment and the habitats provide for plants and animals.

They should be encouraged to identify opportunities for action to care for the immediate surroundings, for example in keeping the classroom tidy, in keeping the school and yard clean, and in 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

Central to the curriculum framework is to inculcate the spirit of the scientific inquiry. The conduct of inquiry found on three integral domains of (1) Knowledge, Understanding and Application, (2) Skills and Processes and (3) Ethics and Attitudes.

These domains are essential to the practice of science. The following shows some components in each one of them.

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

3) Ethics and Attitudes

The curriculum design seeks to enable students to view the pursuit of science as meaningful and useful. In the science curriculum, an end goal is students who enjoy and value science as an important tool in helping them explore their natural and physical world, to appreciate the positive contribution of science and technology to society and to apply important attitudes as:

