

## Science Disciplines for Primary Education in the Republic of Moldova. Determinative analysis.

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### Abstract

The field of Science seeks to promote practical utility, human values, as well as a connection with personal and social problems taught from a student-centred orientation. The incorporation of science into its social/cultural context is considered important in teaching, as the development of scientific knowledge can be regarded as a social practice that is dependent on the political, social, historical and cultural realities of time. The study aimed to analyse the Curriculum in Sciences, which must ensure the directions of action for the achievement of the purpose of this integrative field. In this context, I proposed to research the structure and content of the existing curriculum in the Republic of Moldova through the analysis of the conceptual, teleological, continual, retrospective and prospective framework. As priorities, for the next curricular reform, continuity should be ensured between the levels of education regarding the study of school discipline and ensuring the functional character of school acquisitions.

**Keywords:** *Science education, Science, basic competence in science, inquiry, Science curriculum.*

**1.Introduction.** The need to ensure the appropriate framework for the assimilation of procurement requires the construction of school disciplines by aligning them with international directions, national and local specificities. The discipline of Science in primary classes in the Republic of Moldova is an oblique discipline, with an integrated character. The 2018 curriculum development proposed a new curriculum structure for Science in primary grades. The efficiency and

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effectiveness of these changes determine its vaporization in order to ensure the formation of the basic competence in sciences as well as the formation of the profile of the primary school graduate. The determinative analysis of the curriculum for the Science discipline reveals the need for teleological, content, retrospective changes in order to adjust in perspective.

## **2. Revision of the speciality literature**

The science-technology-society approach requires science to be incorporated into its social and cultural context. This includes examining and questioning the values implicit in scientific practices and knowledge, analysing social conditions as well as the consequences of scientific knowledge and their modifications, and studying the structure and process of scientific activity, from a sociological point of view. But from a philosophical point of view, changes in the development of science and scientific ideas are studied. where contextual science teaching raises questions about the nature of scientific research and assesses the reasons for its validity.

The Science Curriculum is derived from the Policy Framework for the Learning of Science. It encapsulates the thrust of science education to prepare our students to be sufficiently adept as effective citizens, able to function in and contribute to an increasingly technologically-driven world. The conduct of inquiry is founded on three integral domains of competence. These domains are essential to the practice of science. The curriculum design seeks to enable students to view the pursuit of science as meaningful and useful. Inquiry is thus grounded in knowledge, issues and questions that relate to the roles played by science in daily life, society and the environment. Central to the curriculum framework is the inculcation of the spirit of scientific inquiry.

## **3. Research methodology**

The purpose of this research is to analyse the Curriculum in Sciences in accordance with the international and national regulatory framework, which must ensure the directions of action for the achievement of the purpose of this integrative field.

The specific objectives of the research were:

- Analyses the functionality of the curricular elements for the discipline Sciences in primary education and the reference provisions for the Republic of Moldova;
- Determining the directions of action in order to ensure the efficiency and effectiveness of the curriculum for the discipline of Science in Primary Education.

Research hypotheses. In order to achieve the roposal objectives, I establish the following hypothesis:

- If Primary Science Curriculum din Republica Moldova prepare students to be sufficiently adept as effective citizens, able to function in and contribute to an increasingly technologically-driven world, then the functionality of the purchases is ensured.

The research is a determinative analysis based on the content, theoleological, retrospective and prospective component of the curriculum for the discipline of Sciences in the Republic of Moldova.

#### **4. The analysis and interpretation of research**

**4.1 Conceptual framework.** The Science discipline in primary grades is a discipline that refers to the formation of an integral vision of the environment, with its components, processes and phenomena.

The integrated study of the discipline of Sciences proposes the incorporation of different fields in the didactic context for the formation and development of competences, adaptable and applicable to the realities of the time: *biology, geography, physics, ecology and environmental protection*, etc. This process involves the elucidation of the implicit values and the analysis of the conditions for capitalizing on the consequences of applicability for knowledge activities.

The field of Science (OECD), which determined the development of this curriculum, involves the capitalization of information from all spheres of human activity and the formulation of logical hypotheses, which are to be practically validated. The Field of Science (OECD) involves the use of information in all spheres of human activity, in which the essential components of a cognition process are based on formulations of hypotheses to be practically validated. This approach determines the implications of the investigation activity on the environment which, at the primary level, will target aspects such as: understanding the concepts, explaining the processes and the ability to

function efficiently and correctly in various situations, known or unknown, similar to those that can be frequently encountered in real life, and the basic areas of Science will be outlined by:

1. *identification of causal relationships of phenomena, processes in nature;*
2. *explaining the processes/relationships/phenomena of nature;*
3. *the application and evaluation of investigations;*
4. *interpreting data and facts using specific terminology.*

The Organisation for Economic Co-operation and Development (OECD) and the PISA assessment framework evoke the availability of the field of Science, materialized in science education, which implies the ability to use the acquired knowledge, to identify questions and to formulate evidence-based conclusions, in order to facilitate the decision-making process regarding the natural world and the transformations it undergoes as a consequence of human activity (OECD, 2003; 2016).

The Organisation for Economic Co-operation and Development (OECD) and the PISA assessment framework evoke the availabilities of the Science field, materialised in:

1. *Science education* - the ability to use acquired knowledge, identify questions and formulate evidence-based conclusions in order to understand and assist decision-making about the natural world and the changes made to it by human activity (OECD, 2003; 2016).
2. *Basic competence in science* refers to the mastery, use and application of knowledge and methodologies for explaining the surrounding world, understanding the changes caused by human activity and the responsibility of each individual as a citizen.

The basic competence in science and the competences specific to the discipline are achieved by improving the way of learning, which will be achieved in a generative and successive, specific approach based on:

- **learning through investigation/research** – the intentional process of diagnosing problems, conducting experiments and identifying alternatives, planning

investigations, issuing research hypotheses, searching for information, building models, debating with colleagues, and forming coherent arguments (Tamir, 1985);

- **experiential learning** – the process of assimilating new knowledge during a lived experience;
- **Learning – adventure** (expeditionary type) – learning process outside the classroom in authentic natural contexts.

The Science discipline is built on the following areas (OECD, PISA):

| Areas                    | Grade II                                                                       | Grade III                                                                                                                                                                  | Grade IV                                                                                    |
|--------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Life Sciences</b>     | Plants and animals.                                                            | The diversity of the living world.                                                                                                                                         | The diversity of nature.<br>Man-biological being.                                           |
| <b>Earth Sciences</b>    | Lake. Orchards and gardens. Vineyards. Forest.                                 | Land-air living environment.<br>The underground living environment.<br>Aquatic living environment.<br>Human living environments.<br>Natural areas.<br>Republic of Moldova. | Space. Universe.<br>Solar System.<br>Planet Earth. The globe.<br>The Movement of the Earth. |
| <b>Physical Sciences</b> | Phenomena of nature.<br>Weather. Weather.<br>Time. Calendar.<br>Time planning. | Properties of water, air and soil.<br>Aggregation states.<br>The water circuit in nature.                                                                                  | Properties of bodies (natural and processed materials).                                     |

The recommended contents of the Science discipline are related to the principles of the teachers of the disciplines included in the Sciences, approaching the inductive approach from simple to complex, from particular to general, inducing through learning the integrated character of reality according to the three levels of nature study in primary classes:

- *The objects of nature are studied separately through exploration.*
- *The objects of nature are studied in interaction.*
- *Not only the objects of nature are studied, but also the processes, the relationships that take place in nature.*

The design of the current curriculum in Science focused on the following principles:

- *the scientific principle*, which underlies the understanding of natural phenomena, reveals the most elementary and simple connections between certain natural phenomena;
- *the principle of accessibility*, which involves the gradual exposure of knowledge, moving from concrete facts to generalizations, from simpler generalizations to complex generalizations;
- *the systemic principle*, which involves connecting new knowledge with previous knowledge, in order to continuously expand and deepen knowledge;
- *the principle of regional ethnography*, which guides the teacher to get to know the pupils with the objects and phenomena of nature in the given locality, then in the most distant ones;
- *the seasonal principle*, which allows the study of content by direct exploration with the respective season;
- *the ecological principle*, which implies the orientation towards eco-responsible behaviour.

The Science discipline was built on the following specific dimensions:

- **environment** – the totality of the components, living and non-living, of a given place, with which an organism is in contact;
- **process** – the change in the state of a system over a period of time caused by certain factors; any change over time;
- **phenomenon of nature** – the external manifestation of the essence of a thing, a process, etc., accessible, directly perceptible;
- **relations** – the totality of direct and indirect links that are established between two or more objects, organisms or phenomena;
- **environmental protection** – the totality of actions taken by man to preserve the local and global ecological balance.

**4.2. The TELEOLOGICAL FRAMEWORK** of the Curriculum of the Science discipline includes the specific competences of the discipline, the units of competences, the synthetic systems of educational purposes for each of the grades II-IV.

The specific competences of the discipline have a triadic structure, being built from knowledge, capacities/abilities and attitudes/values. In the table below we present the structure of a specific competence of the Science discipline:

| <b>Core Capabilities/Skills</b>       | <b>Knowledge</b>                                                          | <b>Attitudes/Values</b>                                                   |
|---------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Identification and description</b> | <i>components, phenomena, processes, relationships in the environment</i> | demonstrating fairness and consistency in the use of specific terminology |

The specific competences of the Science discipline are developed based on the taxonomy of transdisciplinary competences, taken from the Reference Framework on the National Curriculum and the generic attributes of school graduates. The correlation between the competences specific to the discipline of Science - the categories of competences - the generic attributes of the graduate are indicated below:

| <b>Specific competences of the Science discipline</b>                                                                                                                           | <b>Categories of competences specific to the discipline of study</b>                                                   | <b>Generic attributes Graduate profile</b>                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <b>Identify and describe</b> components, phenomena, processes, relationships in the environment, demonstrating correctness and coherence in the use of specific terminology. | 1. The competence of reception and internalization.                                                                    | <ul style="list-style-type: none"> <li>Active, proactive, productive, creative and innovative people;</li> </ul>                                  |
| 2. <b>Exploration-investigation</b> of the environment, showing curiosity and interest in capitalizing on specific methods and tools for collecting and organizing results.     | 2. Competence of primary processing of data/information, observations;<br>3. Modeling and algorithmization competence. | <ul style="list-style-type: none"> <li>Active, proactive, productive, creative and innovative people;</li> <li>People open to lifelong</li> </ul> |

**Science discipline for primary education in the Republic of Moldova.**  
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|                                                                                                                                                                                          |                                                                                                                         | learning;                                                                                                                                                                   |
| 3. <b>Explanation</b> of the information/results/conclusions obtained in the process of knowing the environment, proving a critical and creative attitude.                               | 4. Competence of expression and argumentation;<br>5. Competence of secondary processing of results, data, observations. | <ul style="list-style-type: none"> <li>• Active, proactive, productive, creative and innovative people</li> <li>• People with confidence in their own strengths;</li> </ul> |
| 4. <b>Solving problem situations</b> based on the integration of purchases from different fields, proving interest in actively promoting environmental values and a healthy way of life. | 6. Integration competence.                                                                                              | <ul style="list-style-type: none"> <li>• Active, proactive, productive, creative and innovative people;</li> <li>• Civically engaged and responsible people.</li> </ul>     |

The competence units of the Science discipline are correlated with the specific competences and content units, aiming at the gradualness, complexity, transferability, contextuality of the competences. The competence units allow the teacher to orient himself towards *what, how much? and how*, to organize the instructional-educational process within the Science discipline.

The introduction of synthetic systems of educational purposes for each of the grades II-IV will clarify and facilitate the understanding by educators/parents, *what the child should know, what the child should be able to do and what attitudes, values the child should possess* at the end of each class in the Science discipline. Thus, the Curriculum would become a useful tool not only for teachers, but also for other actors interested in the instructive-educational process within the Science discipline.

International alignment is important for the approach of the field of Sciences, thus, they should be approached through the prism of teleological directions: provide students with experiences which build on their interest in and stimulate their curiosity about their environment; provide students with basic scientific terms and concepts



to help them understand themselves and the world around them; provide students with opportunities to develop skills, habits of mind and attitudes necessary for scientific inquiry; prepare students towards using scientific knowledge and methods in making personal decisions; help students appreciate how science influences people and the environment.

**4.3. CONTENT FRAMEWORK.** The study of the Science discipline begins with the components of the environment that students can see in the near local environment, then up to the distant one. The selection of the contents for the Science discipline was made in accordance with:

- *diversity of the environment;*
- *the unity of the environment;*
- *responsibility and positive attitude towards the environment.*

**Contents in the second grade:**

- They are classified into the following learning units: *Summer, Autumn, Winter, Spring*. The first season proposed for study is *summer*. Such a configuration offers the possibility for children to learn what they have lived, what they have seen. Also, this permanence of the content units makes it possible to observe the seasonal principle in carrying out long-term planning and conducting outdoor lessons (learning-adventure), applying exploration/investigation activities.

- Each of the content units named above has a similar structure: phenomena of nature specific to the seasons; plants and animals, but also particular units of content: *Weather. Weather (Autumn); Time. Calendar. Time planning (Winter); Life cycles: plants and animals (Spring)*.

- The plants proposed for the study are selected according to their usefulness: cultivated, decorative, fruits, vegetables, etc., and animals - by evolution: insects, fish, etc. The study of animals will be carried out without the use of the taxonomic group name.

**Contents in the third grade:**

1. In the third grade, the deepening, complicating and generalizing of some contents is done. Thus, the knowledge of the world of nevia continues in the unit of content *Water, Air and Soil*.

Knowledge about concrete plants and animals is generalized in the content *Diversity of the Living World*, in which children will study woody and herbal plants, groups of animals: insects, fish, amphibians, birds, mammals and their living environments, then continuing with *Natural Areas*. In order to comply with the principle of continuity in the mentioned content unit, it was proposed to study *the Natural Areas of the Republic of Moldova*, in order to move to the content unit of the *Republic of Moldova*, from which the students will know the place of our country on the map, the waters, the relief of the Republic of Moldova.

2. Within the Living Environments content unit, it is proposed to study *man* through the contents *of the rural and urban life environment of man*, continuing in the fourth grade with: *Man - part of nature; Perception of the environment; Man - biological being*.

**Contents in the fourth grade:**

1. The integration of knowledge about the components of the environment is achieved in the fourth grade on the subject *Diversity of nature*, where children will study living and non-living nature, the materials from which bodies are made. In order to form in students an integral vision of the environment, all classes include topics related to the circuit of the subject: *The life cycle of a plant and an animal* (second grade); *The Water Circuit in Nature* (3rd Grade) and *The Stages of Human Life* (4th Grade).

2. Proposing to carry out the study of the discipline of Science from simple to complicated, from concrete to general, from local to global, the final unit of content is *Space. Movement. The Universe*, in which children will learn about the planets, the Moon, space, the movements of the Earth.

An important element of the current conception of the Science discipline is the formation of children's responsibility towards the environment. Environmental education cannot be carried out on a case-by-case basis, it must be continuous and permanent, so the contents with reference to environmental protection are distributed in each class as follows:

- Environmental protection: *plants and animals* (class II);
- Environmental protection: *natural resources* (class III);

- Environmental protection: *the impact of human activity* (fourth grade).

**4.4. COMPARATIVE CURRICULAR FRAMEWORK.** In the 2018 Curriculum of the Science discipline, the following changes have occurred:

- **Redefining the competences specific** to the discipline in accordance with the categories of purposes specific to the discipline:
  1. *identification, description, explanation, exploration - investigation of environmental processes and phenomena;*
  2. *adopting appropriate behaviour in relation to the environment and one's own health, specifying the predominant skills and attitudinal components.*
- **Ensuring the number of hours necessary** for an efficient teaching-learning-evaluation path: acquisition, understanding, application, analysis-synthesis of acquisitions; implementation of evaluation strategies in the context of EDC.
- **Reformulating the units of competences**, concretizing them and correlating them with the learning contents and activities.
- **Staggering the language elements specific** to the discipline by learning units, by classes.
- **Reorganizing the content units** according to the age particularities, ensuring the interdisciplinary link, observing the general and specific principles of the discipline.
- **Content decongestion**, namely:
  - Human living environments;
  - Visions (scientific and religious) about the appearance of the Earth; The internal and external shells of the Earth (class III);
  - Visions (scientific and religious) about the origin of man; The population of the Earth (human races); Population of the Republic of Moldova (fourth grade); Man - rational and social being.
- **Content transfers:**
  - from the third grade to the second grade:

- Spontaneous flora (plain plants, aquatic plants, forest plants; decorative plants; crop plants – orchard, vineyard, vegetable garden, cereals).
- Animal world in the Republic of Moldova (wild and domestic animals).
- People. The occupations of the people in our country.
- Phenomena of nature.
- from the second grade to the fourth grade:
  - *Nature Module – the world around you*: living bodies, non-living bodies, artificial, natural, terrestrial, celestial;
  - *Module Celestial Bodies*: Solar System (Sun, Planets, Earth, Moon). Space. Placement of the bodies in the following spaces: home, classroom, school, village, city; terrestrial and cosmic. Movement
- **Disintegration of the *Environmental Protection module*** in the third grade, distributing the contents in each class according to domains, based on the principles of education for sustainable development.
- **Diversification of the recommended learning activities**, with a focus on timely activities to train exploration-investigation skills and the formation of a responsible attitude towards nature and one's own health.
- **Introduction of synthetic systems of educational purposes** for each of the grades II-IV.

**5. Conclusion.** Science Discipline capitalizes on inquiry as a way of education for science, through science. The curriculum design seeks to enable students to view the pursuit of science as meaningful and useful. Inquiry is thus grounded in knowledge, issues and questions that relate to the roles played by **science in daily life, society and the environment**. Students need to use scientific knowledge to identify questions, and to draw evidence-based conclusions in order to understand and make decisions about the natural world and the changes made to it through human activity. They also need to understand the characteristic features of science as a form of human

knowledge and inquiry, and be aware of how science and technology shape the material, intellectual and cultural environments. Aspect identified in the analyzed curriculum.

*The continuity of the approach of the Science field must be ensured between the levels of education, an aspect that is lacking in the Republic of Moldova, the prioritization of certain subjects leads to the performance deadline.*

Another dimension to be ensured is the functionality of procurement, thus avoiding that the discipline involves only the informative role and will thus focus on the formation of environmental values such as curiosity, creativity, integrity, objectivity, open mindedness, perseverance, responsibility.

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