NA-MA POTI

Scientific literacy

Definition and building blocks

National Education Institute Slovenia

NA-MA POTI

REPUBLIC OF SLOVENIA
MINISTRY OF EDUCATION, SCIENCE AND SPORT

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DEFINITION OF SCIENTIFIC LITERACY

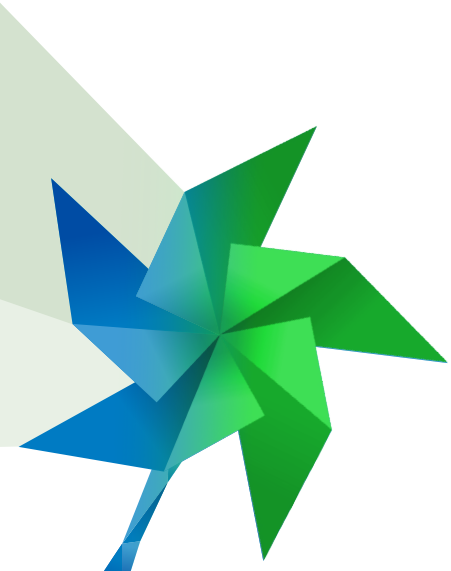
Scientific literacy encompasses a person's **science knowledge**, **scientific skills** and **attitude** towards science.
It is based on the use of knowledge, skills to:

- **Discuss** science/scientific issues;
- **Gain** new knowledge;
- **Explain** science phenomena;
- **Derive** findings about science topics that are based on data and evidences.

Scientific literacy also includes **understanding the characteristics of natural sciences** as a form of human knowledge and inquiry; **awareness** of how natural sciences and technology shape our material, intellectual and cultural environment; and **willingness to participate** and **ability to communicate** about science/scientific issues as a contemplative individual responsible towards nature and society.

List of abbreviations

NP – scientific literacy
NA-MA POTI – Scientific and Mathematical Literacy:
The Development of Critical Thinking and Problem-solving



BUILDING BLOCKS AND SUB-BUILDING BLOCKS OF SCIENTIFIC LITERACY

A scientific literate person is able and willing to join informed debates about natural sciences and technology, for which the following competences are required:

1. EXPLAIN PHENOMENA SCIENTIFICALLY

1.1. Recalls, integrates and uses science knowledge to describe/explain phenomena using expert science terminology;
1.2. Obtains appropriate and relevant information from sources to explain concepts and phenomena, and knows/uses scientific databases;
1.3. Recognizes, uses and creates (scientific) explanations of phenomena that include various representations, models and analogies;
1.4. Recognizes and explains the potential use, impacts and consequences of science knowledge for an individual, society, nature and the environment.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

2.1. Recognizes and assesses contents* which can be scientifically inquired, and defines the inquiry problem;
2.2. Poses inquiry questions;
2.3. Generate appropriate predctions/hypotheses (for the inquiry*);
2.4. Designs the (scientific) inquiry by steps/phases;
2.5. Conducts the inquiry safely, responsibly and systematically, and uses aids appropriately ***;
2.6. Organizes, analyses and interprets the (acquired) data;
2.7. Analyses (critically assesses the implementation of) the inquiry, suggests improvements, and communicates the inquiry (results).

3. ATTITUDE TOWARDS SCIENCE

3.1. Acts as a part of nature and maintains a responsible attitude towards nature and the environment;
3.2. Develops and demonstrates an appropriate attitude towards the natural sciences and scientific research.

LEGEND: * questions/topics/problems/issues/phenomena ... ** inquiry/experiment/making a product ... *** aids/measuring devices/apparatuses/laboratory equipment/substances ...

1. EXPLAIN PHENOMENA SCIENTIFICALLY

. . . a person recognizes, explains and evaluates an explanation of natural and technological phenomena, processes, laws and their correlation/interdependence within systems . . . which he/she demonstrates in the following way:

1.1. RECALLS, INTEGRATES AND USES SCIENCE KNOWLEDGE TO DESCRIBE/EXPLAIN PHENOMENA USING SCIENCE/EXPERT TERMINOLOGY

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Perceives, discovers and examines himself/herself and his/her immediate surroundings (simple phenomena) using all the senses, and describes them using appropriate vocabulary; b) Uses his/her own words and science expert words to explain the simple phenomena which he/she can come across in the immediate surroundings; c) Differentiates between cause and consequence when describing/explaining phenomena.	a) Recalls his/her own experience and ideas about phenomena from the immediate surroundings and integrates them with the knowledge assimilated; b) Uses appropriate science expert words and phrases to describe/explain simple phenomena in accordance with the curriculum objectives; c) Differentiates between cause and consequence when describing/explaining phenomena.	a) Recalls the relevant knowledge and uses it to explain the phenomena in the immediate and broader surroundings; b) Sensibly integrates, edits/organizes data/concepts into a simple hierarchical structure; c) Uses basic science expert terminology to describe/explain phenomena (in writing and orally) in accordance with the curricula objectives; d) Differentiates between cause and consequence when describing/explaining phenomena.	a) Recalls and integrates the assimilated science knowledge (relating to all science curricula) and uses it to describe/comprehensively explain phenomena/processes (even abstract ones) within the discussed systems; b) Sensibly integrates, edits/organizes data/concepts into a hierarchical structure; c) Uses basic science/expert terminology to describe/explain phenomena/processes in accordance with the curricula objectives (orally and in writing, also by using digital technology); d) Knows the principle of causality.	a) Recognizes natural and technological phenomena, processes and laws in theory and practice, and consistently uses science expert terminology (in accordance with the curricula objectives) and professional arguments (orally and in writing, also by using digital technology) to comprehensively explain phenomena/processes; b) Uses the assimilated science expert terminology, concepts and theories to comprehensively explain more complex phenomena/processes, thus demonstrating an understanding of nature as an interdependent entity; c) Sensibly integrates, edits/organizes data/concepts into a hierarchical structure; d) Applies the principle of causality.

1. EXPLAIN PHENOMENA SCIENTIFICALLY

. . . a person recognizes, explains and evaluates an explanation of natural and technological phenomena, processes, laws and their correlation/interdependence within systems . . . which he/she demonstrates in the following way:

1.2. OBTAINS APPROPRIATE AND RELEVANT INFORMATION FROM SOURCES TO EXPLAIN CONCEPTS AND PHENOMENA, AND KNOWS/USES SCIENTIFIC DATABASES

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Obtains information from the immediate surroundings and relevant sources; b) Differentiates between the fantasy world and the real world.	a) Obtains the information needed to explain phenomena from concrete situations and various appropriate sources; b) Assesses whether a source is based on imagination or reality.	a) Collects the relevant data/information needed for the explanation and cites the sources appropriately; b) Recognizes the characteristics of the proposed database; c) Uses the proposed relevant and reliable databases (searching for the required data).	a) Independently looks up the data/information needed for the explanation; b) Knows and uses various sources, and cites them appropriately; c) Assesses the relevance of the data/information from various sources and the sources' reliability; d) Knows and uses the proposed relevant and reliable data reliable data bases.	a) Independently looks up all the required data/information, critically evaluates them based on the relevance and reliability of the sources, and can substantiate/explain his/her choice; b) Finds, knows and uses a few relevant and reliable databases, and builds and uses his/her own database; c) Sorts data/information (sources) according to the intended use/functionality for each assignment; d) Consistently quotes and cites sources according to the standards of each field.

1. EXPLAIN PHENOMENA SCIENTIFICALLY

. . . a person recognizes, explains and evaluates an explanation of natural and technological phenomena, processes, laws and their correlation/interdependence within systems . . . which he/she demonstrates in the following way:

1.3. RECOGNIZES, USES AND CREATES EXPLANATIONS OF PHENOMENA THAT INCLUDE VARIOUS REPRESENTATIONS, MODELS AND ANALOGIES

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Describes/explains (non-verbally and verbally) science phenomena/processes from the immediate surroundings using simple representations; b) Differentiates between a model and a real object/phenomenon/process.	a) Explains the main characteristics of the observed science phenomena/processes using various simple representations, models and analogies in a creative way; b) Differentiates between a model and a real object/phenomenon/process.	a) Explains (orally and in writing) the observed science phenomena/processes using various simple representations, models and analogies in a creative way; b) Incorporates the main characteristics and the key details into the explanation of science phenomena/processes using representations/models; c) Creates and uses simple models, and identifies their limitations.	a) Explains science phenomena/processes (in a popular science way) using appropriate representations, models and analogies (orally and in writing, also by using digital technology); b) Explains the same science phenomenon/process using different (types of) models and identifies the advantages and disadvantages of each model; c) Knows that scientific explanations of phenomena/processes are based on proven facts and laws; d) Begins to differentiate between scientific and non-scientific explanations.	a) Uses and creates appropriate representations, models and analogies (orally and in writing, also by using digital technology) to comprehensively explain complex science phenomena/processes and technological processes; b) Comparatively assesses the relevance (advantages and limitations) of models and analogies; c) Differentiates between scientific and non-scientific explanations; d) Knows the negative consequences of a non-scientific explanation of phenomena/processes and knows that scientific explanations are based on proven facts and laws but have a limited scope.

1. EXPLAIN PHENOMENA SCIENTIFICALLY

…a person recognizes, explains and evaluates an explanation of natural and technological phenomena, processes, laws and their correlation/interdependence within systems…which he/she demonstrates in the following way:

1.4. RECOGNIZES AND EXPLAINS THE POTENTIAL USES, IMPACTS AND CONSEQUENCES OF SCIENCE KNOWLEDGE FOR AN INDIVIDUAL, SOCIETY, NATURE AND THE ENVIRONMENT.

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) When presenting examples of technological discoveries, he/she mentions their use in everyday life.	a) When presenting examples of scientific and technological discoveries, he/she describes the aspects of their use and mentions their impacts.	a) Recognizes scientific and technological discoveries, whose use has significantly improved the quality of people's lives, and assesses their impacts on an individual, society, nature and the environment.	a) Distinguishes between basic and applied inquiry, and is aware of their importance for science knowledge; b) Understands (recognizes and explains) the positive and negative impacts and consequences of the knowledge of science and technology for an individual, society, nature and the environment.	a) Gives examples of the application of the findings of basic and applied inquiry, and critically assesses their impacts and consequences for an individual, society, nature and the environment; b) Predict potential consequences of the application of science and technology knowledge in hypothetical situations.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.1. RECOGNIZES AND ASSESSES CONTENTS WHICH CAN BE SCIENTIFICALLY INQUIRYED, AND DEFINES THE INQUIRY PROBLEM

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Observes/ detects, recognizes, ...science contents from his/her daily life/environment; b) Makes various claims about science contents he/she is interested in, using his/her own words; c) Proposes, based on examples/ experiences, what and how he/ she could inquire in a unique way.	a) In his/her own environment/ based on examples/based on his/her own experience, recognizes science contents which can be (scientifically) inquired; b) Describes the inquiry problem in his/her own words; c) Suggests ways to easily (scientifically) inquire the selected issues.	a) Recognizes contents from his/ her daily life which can be scientifically inquired; b) Describes the inquiry problem in his/her own words; c) Suggests ways to scientifically inquire specific issues and substantiates his/her suggestions.	a) Assesses the possibilities and reasonableness of scientifically inquire the issues; b) Assesses which issues he/ she can scientifically inquire independently (under the given circumstances), and defines the inquiry problem; c) Suggests ways (with or without the help of sources) to scientifically inquiry specific issues, and substantiates his/her suggestions.	a) Assesses the reasonableness of scientifically inquiring the issues and of using an interdisciplinary approach to do so; b) Assesses which contents he/ she can scientifically inquire independently (under the given circumstances), and defines the inquiry problem; c) Gives informed suggestions (with or without the help of sources) of ways to scientifically inquire specific issues, and evaluates his/her suggestions.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.2. POSES INQUIRY QUESTIONS

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Uses his/her own words to pose/form questions about science contents in his/her environment, depending on his/her interests.	a) Forms various sensible inquiry questions that are based on observing the environment, on the learners' thoughts or interests.	a) Focuses on the problem he/she wants to inquiry and can convert this interest into inquiry questions; b) Forms inquiry questions using different interrogative words and are based on the assimilated science knowledge.	a) Poses inquiry questions that are based on the assimilated science knowledge and beyond; b) Poses inquiry questions the answers to which can be verified through experiments; c) Recognizes a potential inquiry question from the description of inquiry results.	a) Poses (quality) inquiry questions that are based on the assimilated science knowledge and beyond; b) Poses inquiry questions the answers to which can be verified through experiments (in the school setting); c) Recognizes a inquiry question(s) from the analysis of inquiry results.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.3. GENERATE APPROPRIATE PREDICTIONS/HYPOTHESES (FOR THE INQUIRY)

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Guesses/predict what will happen during the phases of the inquiry (what the phenomena will look like during observation) or what the result will be (and why).	a) Predict what will happen during the phases of the inquiry or what the inquiry result will be based on the inquiry question and experience; b) When forming the predict / hypothesis, learners answer questions of the following type: How would it happen/what would happen if we changed ...? c) Recalls a personal experience(s)/prior knowledge to explain the predict.	a) Predict what will happen or what the inquiry result will be, based on the inquiry question; b) When forming the predict / hypothesis, learners answer questions of the following type: How would it happen/what would happen if we changed ...?, taking into account what would be changed and what would not; c) Substantiates the prediction with experiences/(prior) knowledge.	a) Forms/proposes a knowledge-based hypothesis (hypotheses) based on the inquiry question; b) Forms hypotheses that include a dependent and independent variable, using the phrase "If/As soon as ... then ... because ..."; c) Evaluates the formed hypothesis and distinguishes between an unfounded prediction and a hypothesis; d) Can discern the dependent and independent variable from the given hypothesis.	a) Forms/proposes a scientifically verifiable hypothesis (hypotheses) based on the inquiry question and knowledge; b) Forms hypotheses that include a dependent and independent variable(s); c) Evaluates hypotheses from the expert point of view and in relation to the inquiry question; d) Proposes/differentiates hypotheses that can be verified by conducting inquiry under the given/school conditions; e) Deduces the inquiry questions from the given hypothesis and discerns the dependent and independent variable(s) from the hypothesis.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.4. DESIGNS/PLAN THE (SCIENTIFIC) INQUIRY BY STEPS/PHASES

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Chooses the most suitable of the (two) proposed methods of implementation; b) Proposes how he/she would design the inquiry (the order of steps), what he/she would be observing and/or measuring, and how safety would be ensured.	a) Designs the inquiry and thinks about all that could affect the course/outcome of the inquiry (also from the aspect of safety); b) Describes the design of the inquiry, also predicting the method of collecting and recording data (observing, measuring); c) Assesses whether the experiment is fair or not based on simple examples.	a) Designs the inquiry (also from the aspect of safety) and defines what/which variable he/she will be changing during the inquiry and how, and what will remain unchanged; b) Describes the design of the inquiry, predicting/suggesting which data he/she will be collecting with the inquiry and how (observing, measuring); c) Assesses the fairness of the experiment case-by-case and knows its importance; d) Plans all (aids) that he/she will need when implementing the inquiry.	a) Designs the inquiry (also from the aspect of safety), defining the key factors as the dependent and independent variable and constants; b) Makes an inquiry plan, envisaging the qualitative (e.g. observation) and quantitative (e.g. measurement) methods of collecting the relevant data; c) Designs a fair experiment and knows its importance; d) Suggests a suitable sample for the inquiry; e) Plans/chooses the aids according to the type of inquiry and/or measurements, and predits the suitable number of measurements; f) Designs/recognizes a control (reference) experiment in selected inqieries; g) Knows the importance of the repeatability of the inquiry.	a) Designs the inquiry, defining the inquiry, design factors, the studied variables (dependent and independent) and the controlled variables (constants), and predicts their interaction; b) Obtains data on the safe and ethical implementation of the planned inquiry, envisages potential dangers, and plans appropriate safety measures and protection (also of the collected data); c) Makes a inquiry plan, choosing the quantitative or qualitative methods of collecting data (also by using digital tehnology) according to the inquiry purpose, and is aware of the aspect of subjectivity and objectivity in obtaining data/ measuring; d) Designs a fair experiment and is aware of its importance and limitations;

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.4. DESIGNS/PLAN THE (SCIENTIFIC) INQUIRY BY STEPS/PHASES

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
				e) Suggests appropriate sampling and sample for the inquiry, taking into account the statistical laws (size, structure, randomness, representativeness, exclusion criteria); f) Plans/chooses the aids based on the type of inquiry and/ or measurement, and decides on an appropriate number of measurements; g) Designs, recognizes and substantiates the use of control experiments in the inquiry, and differentiates between a controlled experiment and a control experiment; h) Knows the causes of uncertainty in measurement and knows that each measurement has limited precision (the impact of a systematic and random error); i) Substantiates the importance of the repeatability of inquiry.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.5. CONDUCTS THE INQUIRY SAFELY, RESPONSIBLY AND SYSTEMATICALLY, AND USES AIDS APPROPRIATELY

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) When conducting the inquiry, he/she follows the work instructions and ensures his/her safety, the safety of others and of the environment, and handles organisms and their parts ethically; b) Uses suitable (everyday) aids and "records" observations/measurements.	a) When conducting the inquiry, he/she follows the plan/work instructions and ensures his/her safety, the safety of others and of the environment, and handles organisms and their parts ethically; b) Prepares/assembles (according to instructions) the aids needed to conduct the inquiry; uses appropriate simple aids and records observations/measurements.	a) When conducting the inquiry, he/she follows the plan/instructions and conducts it safely and responsibly; handles organisms and their parts ethically; b) Prepares/assembles (according to instructions) the aids needed to conduct the inquiry; uses aids appropriately and "records" observations/measurements in an organized manner.	a) When conducting the inquiry, he/she follows the plan/instructions and conducts it safely and responsibly, and handles organisms and their parts ethically; b) Prepares/assembles the aids needed to conduct the inquiry and uses them independently and appropriately; c) Systematically records observations; correctly reads the measured values and writes them down properly (with units, etc.).	a) When conducting the inquiry, he/she follows the plan/instructions and conducts it safely and responsibly, handles organisms and their parts ethically, and is familiar with the potential consequences of conducting inquiry in a dangerous, unethical and irresponsible manner; b) Uses the aids independently and according to the manufacturer's instructions; c) Systematically records observations; correctly and accurately reads the measured values and writes them down properly (with units and measurement uncertainty); d) Suggests the use of alternative measuring aids and procedures.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.6. ORGANIZES, ANALYSES AND INTERPRETS THE (ACQUIRED) DATA

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Uses the data to create simple representations; b) Explains the findings obtained from observation or during simple inquiry in his/her own way.	a) Organizes the data into select representations; b) Reads data from representations and draw findings/conclusions; c) Recognizes potential simple relationships/patterns in the data.	a) Organizes the data into select representations; b) Recognizes simple relationships/ patterns in the organized data and draw conclusions.	a) Organizes the data into appropriate representations (also by using digital tehnology); b) Analyses data, recognizes relationships (causes and consequences) between data and potential patterns, and from them derives laws and draw conclusions; c) Interprets the data using relevant knowledge and expert/ science terminology, and is familiar with some of the pitfalls of simplification; d) Distinguishes between assuppositions, evidence and conclusions; determines whether claims/generalizations/ conclusions are based on scientifically obtained data/ evidence.	a) Organizes/processes the data into appropriate representations (also by using digital tehnology) and substantiates the use of representations to achieve the desired highlights (avoids manipulating representations); b) Systematically analyses data, recognizes the interdependence between data and potential patterns, and from them derives laws and draw conclusions, while taking into account the reliability of the data and the pitfalls of simplification; c) Interprets the data using relevant/valid knowledge and science/expert terms, is familiar with the possibilities of data manipulation and avoids them; d) Differentiates between assuppositions, evidence and conclusions; substantiates whether claims/generalizations/ conclusions are based on scientifically obtained data/ evidence.

2. SCIENTIFIC INQUIRY, INTERPRETING DATA AND EVIDENCE

. . .a person describes, designs, implements and evaluates experiments/inquiry; suggests ways of scientifically addressing issues; using various reprezentations and methods scientifically analyses and evaluates the data, claims and arguments; and sums up the relevant conclusions . . . which he/she demonstrates in the following way:

2.7. ANALYSES (CRITICALLY ASSESSES THE IMPLEMENTATION OF) THE INQUIRY, SUGGESTS IMPROVEMENTS, AND COMMUNICATES THE INQUIRY (RESULTS)

PRE-SCHOOL EDUCATION ages 1-6	BASIC EDUCATION			UPPER SECONDARY SCHOOL ages 15-19
	FIRST EDUCATIONAL CYCLE ages 6-9	SECOND EDUCATIONAL CYCLE ages 9-12	THIRD EDUCATIONAL CYCLE ages 12-15	
a) Leads a guided discussion about all that affects the course of the inquiry and suggests changes (improvements) to conducting the inquiry; b) Suggests other things that could be inquiryed; c) Talks about the inquiry and explains it.	a) Evaluates the implementation of the inquiry and suggests changes (improvements) to conducting the inquiry; b) Suggests other things that could be inquiryed and how; c) Describes/presents the course of the inquiry with conclusions, and answers questions.	a) Evaluates the implementation of the inquiry and highlights the main flaws and limitations in conducting the inquiry; b) Thinks about what he/she would do differently next time (or if the results are unexpected) and poses new inquiry questions; c) Presents specific phases of the inquiry and participates in a discussion about the conclusions.	a) Analyses the implementation of the inquiry (posing inquiry questions and hypotheses; accuracy/reliability of the results; economical and safe implementation, etc.); b) Suggests improvements or alternative implementation of the inquiry; c) Presents the phases of the inquiry and actively participates in a discussion about the conclusions.	a) Analyses/evaluates/reflects on the implementation of the inquiry (posing inquiry questions and hypotheses; accuracy/reliability of the results; economical and safe implementation; suitability of the sample; measurement uncertainty) and highlights the flaws in the implementation; b) Suggests possible changes, sensible and real improvements, and alternative implementation of the inquiry; c) In different ways (also by using digital tehnology) presents the inquiry (describes and discusses individual phases of the inquiry or the inquiry as a whole) and leads a discussion about the conclusions.

3. ATTITUDE TOWARDS SCIENCE

… a person develops an appropriate attitude (values, opinions, beliefs, etc.) and adopts a proactive stance towards nature, environmental protection, natural sciences and inquiry… which he/she demonstrates in the following way:

3.1. ACTS AS A PART OF NATURE AND MAINTAINS A RESPONSIBLE ATTITUDE TOWARDS NATURE AND THE ENVIRONMENT

3.1.1. Is aware of his/her role in nature, which stems from an understanding of the integrity and complexity of nature and of the interdependence between stakeholders;

3.1.2. Acts responsibly towards nature and the environment by:

- Being aware of the consequences of his/her actions and of the human impact on nature and the environment as an entity;
- Behaving in accordance with the principles of environmental protection and the principles of sustainable development;
- Contributing to detecting, warning about, raising awareness about, and solving environmental or nature conservation problems in the local environment and beyond;
- Striving for an ethical attitude towards all living beings and towards conserving biodiversity.

3.1.3. Shows an interest in observing, studying and experiencing nature;

3.1.4. Can find inspiration in nature and sources of well-being for a higher quality of life.

3.2. DEVELOPS AND DEMONSTRATES AN APPROPRIATE ATTITUDE TOWARDS THE NATURAL SCIENCES AND SCIENTIFIC RESEARCH

3.2.1. Supports the natural sciences and values (new) findings of the natural sciences as some of the main achievements of civilization, which he/she demonstrates in the following way**:**

- Takes into account/acknowledges different aspects of natural sciences and uses scientifically proven facts and findings to act sustainably;
- Demonstrates a need for logical and precise methods of reaching findings;
- Is aware of the importance of the inquiry methodologies of different natural sciences;
- Is aware of the impact of (natural) sciences on the quality of life of all living beings and their contribution to searching for solutions in the efforts towards sustainable development;
- Applies (science) knowledge responsibly and ethically.

3.2.2. Demonstrates an interest in natural sciences/scientific inquiry, which he/she substantiates by**:**

- Developing an inquisitive/knowledge-thirsty and critical attitude towards the natural sciences, achievements, phenomena, etc.;
- Demonstrating a willingness (pleasure) to conduct scientific inquiry as a way to deepen his/her own science knowledge and abilities/skills;
- Learning about professions in the field of science or those relating to science knowledge, and assessing career opportunities.

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