ACCADEMIA MEDICA DI ROMA

A HEALTH SCIENCE EDUCATION PROGRAMME IN PRIMARY SCHOOL

THE SCIESA PROJECT

FIFTH YEAR

2017-18

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A HEALTH SCIENCE EDUCATION PROGRAMME IN PRIMARY SCHOOL THE SCIESA PROJECT

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INDEX

Introduction 6
Characteristics of the SCIESA Project and summary of the previous activities 7
1. Motivation, objectives and methods of implementation of the project 7
2. Articulation of the general teaching programme 13
3. Activities completed in previous years 15

Module 10: *THE FLOW OF ENERGY FROM THE SUN TO OUR FOOD*
Food as a source of molecules and energy 16
Expected learning outcomes 16
Subject matter 17
1. The origins of the molecules that make up our bodies 17
2. The use of energy present in foodstuffs 21
3. Teaching support material 32

Module 11: *RISK FACTORS AND PROTECTION OF THE ORGANISM AND THE ENVIRONMENT*
Introduction and background information for teachers 48
- *Mini-module 11.1 Accidental risks and how to prevent them* 55
Expected learning outcomes 55
Subject matter 56
- *Mini-module 11.2 The risk of infection and the defences of the organism* 59
Expected learning outcomes 59
Subject matter 60
Background Information for the teacher 64
Teaching support material 68
- *Mini-module 11.3: Too much and too little*
The risk of disequilibrium in eating, in physical activity and in the sleep/wake cycle 76
Expected learning outcomes 76
Subject matter 76
Teaching support material 89

- *Mini-module 11.4: From anger to violence* 96
Expected learning outcomes 96
Subject matter 96
Teaching support material 102
- *Mini-module 11.5: Addiction*
Feeling well and being free 109
Expected learning outcomes 109
Subject matter 111
Teaching support material 126
Evaluation of completed work 148
a) observations taken during class visits 149
b) analysis of the two end of the year tests 153
c) evaluations and comments by the parents on the SCIESA project through a questionnaire 166
d) evaluations and comments by the teachers 168
e) presentation of the *Tree of Life* made by the pupils to their parents 170
Questionnaire 171

INTRODUCTION

The fifth year of activity of the SCIESA project (SCIEnze della SAlute) was delivered in the 2017-2018 school year, as an initiative of the Accademia Medica di Roma, with the sponsorship of the Accademia Nazionale dei Lincei. The SCIESA project is an on-going experimental programme to teach health science over the five-year cycle of primary education. As during the previous four years, the project was delivered in two schools, in Via Asmara and Via Novara, both part of the Istituto Comprensivo Luigi Settembrini in Rome. The programme was taught to the same classes already involved in the previous years' project, who were then in their fifth year of primary school. The planning and supervision of the project was run by the SCIESA working group, composed of Mario Stefanini, M.D., developmental biologist, fellow of the Accademia Nazionale dei Lincei, Antonio Cappelli, M.D., epidemiologist; Flavia Capozzi, M.D. child neuro-psychiatrist, all belonging to Sapienza University of Rome; Silvia Caravita, biologist, expert in scientific education at the IRPPS (CNR) Rome, and Gregorio Siracusa, M.D., anatomo-physiologist, at the University of Rome Tor Vergata.

The programme was delivered by the same teachers as in the previous years, Paola Cherubini, Roberta Corvi, Grazia Cossu, Elena Feliziani, Maria Eleonora Medici, Grazia Zimbalatti, with Serena Porcelli replacing Annarita Pierini, under the guidance of the school headmaster and of Angelo Matrone and Claudia Regazzini, coordinators of Via Novara and Via Asmara schools, respectively. Approximately 80 pupils were involved in the experiment.

The project has been financed by the Fondazione Terzo Pilastro Italia e Mediterraneo during its first, third and fifth year and by the InterAcademy Partnership, through the UNESCO, during its second and fourth year.

As with previous years, the present report – detailing the activities realised during the fifth year of the project – has been written in English and Italian, and can be accessed at the web site of the Accademia Medica di Roma, at the following link:
http://www.accademiamedicadiroma.it/index.php?option=com_content&view=article&id=573&Itemid=106 ,

as well as at the web site of the *InterAcademyPartnership (IAP) for Health*:
http://www.iamp-online.org/content/health-science-education-compulsory-primary-schools
(the SCIESA project has become an IAP project since 2014).

CHARACTERISTICS OF THE SCIESA PROJECT AND SUMMARY OF PREVIOUS ACTIVITIES

1. Motivation, objectives and methods of implementation of the SCIESA project (SCIEnze della SAlute)

1.1 Motivation

Developing a Science for Health education programme in a primary school was an idea stemming from an analysis of epidemiological data of the Italian population, which is strongly characterised by:

– an ageing population with consequential increase of chronic or degenerative diseases;
– the diffusion of a wide range of diseases typical of the "affluent society", defined by the WHO *Non Communicable Diseases* (*NCD*), and known to be linked with incorrect and risky health lifestyles (e.g. eating disorders, smoking, substance abuse disorders, sedentary lifestyles, stress, etc.).

As a consequence of these phenomena, the overall demand for health care is increasing, with consequent greater costs for the National Health Service.

Among the prevention activities, special relevance is given to *primary prevention,* aimed at eliminating or at least in counteracting the root causes of those morbid events that one wants to fight.

Health education is considered as an adequate preventive approach to reduce the diffusion of the above mentioned pathologies. Initiatives in this direction are subject to criticism. Indeed, it can be observed that the general effectiveness of health education programmes in the primary school system is rather limited as:

– they are generally delivered as occasional or sporadic events;

– in most cases, the learners lack basic scientific trainings, even at an elementary level, indispensable for long-lasting and effective learning;
– the information which is transmitted is perceived as an undisputed truth, not based on scientific evidence.

These critical issues underpin the need of a new concept of *health education*, played as a systematic activity to "promote health", focused on the appreciation of "healthy and correct lifestyles". This new approach to a *science-based health education*, has to be based on the aware knowledge of own body, of its regulative mechanisms, and of the major health risk factors to be avoided.

In this direction, an effective health education programme in primary schools is of the outmost importance for a number of reasons.

Firstly, primary school pupils are the appropriate target for such educational activity because:

- basic educational issues are established at an early age;
- compulsory school allows an entire age segment to benefit from such activities;
- the bases for health *vs*. disease in adults are laid down in childhood;
- if efficiently conducted, these activities could raise awareness among the pupils' families as well.

Secondly, a targeted educational project may contribute to the long-term prevention of chronic pathologies that share risk factors, such as unhealthy diet, lack of physical activity, alcohol abuse, smoking, drugs consumption. Recent data from the *World Health Organisation* (WHO) show that 70% of all deaths are caused by *non communicable diseases* (NCDs). In addition, the rapid rise in NCDs is predicted to hinder poverty reduction initiatives in low-income countries.

Finally, such approach may easily introduce the pupils to a teaching method based on their active participation in the learning process through inquiry (Inquiry Based Science Education, IBSE) – a method that is considered to favour the re-elaboration of acquired knowledge in a structured and long-lasting form – as well as through

experiments and their recalling personal experiences. IBSE-based pilot projects are presently being implemented with success in many countries. Only a few of them, however, have explored the connections between science and health education, with interesting but limited impact and developments.
In essence, the core of the above mentioned educational activity is to transmit to the pupils, even if at an elementary level, the basic scientific understanding on the structure/functions of their own body and to contribute to their ability to positively face problems in life, by acquiring the so called *skills for life*, as defined by WHO.

1.2 Aims

With these premises in mind, the SCIESA project was conceived with the purpose to verify the feasibility of delivering to a target of primary school pupils a systematic *science based health educational programme* having the final aim of transmitting to these young learners an understanding on the conformation and functioning of the human body and of getting them to a personal, rational and scientific appreciation of lifestyles that can be considered as appropriate to help prevent the onset of certain infectious or degenerative pathological conditions. To this aim, the basic knowledge to be transmitted, appropriately framed to the learning abilities of primary school pupils, should primarily include the following:

- the general conformation and the main functions of the human body;
- the continuous exchanges that occur between the human body and the external environment;
- the relationships with others, and in general with the external environment;
- the major health risk factors which can be met even at a young age, such as an unhealthy diet, lack of physical activity, alcohol abuse, smoking, drugs consumption;
- behaviours and lifestyles aimed at avoiding or contrasting those risk factors, thus preventing the onset of illness which can be established both at a young age or during adulthood.

For the present feasibility study, the project was formulated to be delivered to four classes over the entire five-year primary school duration, beginning at the first school year.

1.3. Method of intervention

The educational strategy adopted to achieve the above objectives is based on two basic principles: the use of the inductive method, and the active participation of learners during delivery of the programme. This strategy, aimed at enhancing the critical capacity of the pupils within an evidence-based educational programme, also implies:

– identifying and valorising everyday activities of the pupils (family life, school activities, physical exercise, play, conditions of well-being or sickness, etc.), to be used to create the foundations for a learning based on real, spontaneous or elicited, experiences;

– the direct pupils participation in the learning process through the systematic involvement of each individual in the group, and by encouraging interaction between group members;

– the continual training of the teachers involved in the delivery in the classroom of the proposed programme;

– the collaboration of the pupils' families, by means of periodic information sessions (letters to parents, meetings, etc.) concerning the ongoing program;

– adopting an inductive methodology during the planning and implementation of the programme, to enhance reflexions on the experience itself, and to create solid foundations for effective learning, thus avoiding teaching based on the mere transmission of notions.

The syllabus for each year of the programme was essentially prepared according to the following plan:

a) Identification of "basic experiences"

Taking into consideration their age and social background, the pupils would be made to recall some of their own basic, everyday experiences, to be used as a part-of the programme.

b) Preparation of the teaching programme

The school year-long programmes were prepared by the SCIESA working group together with the teachers, and were articulated into various Modules to be used by the same teachers as a teaching guide. The Modules would be focused on a series of topics pre-selected in consideration of the general guidelines of the project, but also on the basis of suggestions and experiences coming from previous years' activities. A "flexible" teaching programme was considered as more suitable for the effective delivery of an experimental programme with several innovative aspects.
Each module was to include:

- references to possible common daily experiences to be recalled by the pupils, in relation to the topics to be discussed;
- identification of specific learning objectives pertaining to the module;
- the analytical identification of the knowledge to be transferred;
- the methods, when possible inductive (*experience and evidence based*), to be applied when transferring a specified knowledge;
- a list of teaching support materials with indications on how these should be used.

c) Planning and production of the teaching support materials

The teaching support materials considered as necessary for the delivery of each module (materials required for simple experiments, role plays, pictures/illustrations to be studied, etc.) were produced by the SCIESA working group – or in certain cases taken from the *web* – and were presented to and discussed with the teachers.

d) Workshops with teachers

Given that the programme was to be delivered by the regular school teachers, various meetings between the teachers and the SCIESA working group were held before and during the delivery of the programme. The aims of the meetings were:

- to illustrate and discuss the programme, and to make any necessary adjustments;
- to give teachers the necessary indications, instruments and any other information (use of teaching support materials, etc.) necessary for the delivery of the module;

- to provide the teachers with a brief introduction to some notions of health science pertaining to the teaching modules (*background training* for the teachers).

The meetings would be conducted with a "teamwork" approach, before the start of the teaching activity and also during the class activity.

e) Presentation to the pupils' families of the activity to be delivered

To encourage active collaboration, a meeting with the families would be held before the start of the programme to present the project and its objectives. The teachers involved in the delivery of the project, the school supervisors and members of the SCIESA working group were to be present. During the school year, additional meetings would be programmed with the pupils' families, to receive feedback and comments regarding the on-going activities.

f) Implementation of the planned programme

To guarantee a certain "continuity" in the teaching activity (for a total of 40 hours in the school year) delivery of the programme was to be entrusted to the regular class teachers who, however, received continual monitoring and technical assistance from members of the SCIESA working group.

g) Assessment of results

Evaluation of the achieved learning outcomes was to be obtained according to a project which would include:

- evaluation by the teachers of the students' individual learning, obtained through appraisal tests or *ad hoc* class activities;
- meta-analytic evaluation of the knowledge acquired by the pupils;
- meta-analytic evaluation – based on periodic documentation of conversations in the classroom – regarding the pupils capacity of inductive reasoning, their ability to explain their reasoning, and to draw logical and correct conclusions,;
- evaluation of the level of appreciation and critical observations by the teachers involved in the programme, the school directors, and the pupils' families.

2. Articulation of the general teaching programme

As previously stated, the general teaching programme was conducted in a flexible manner, and was modified on critical analysis of the activities run in previous years.

The initial part of the programme (*learning to read the book of nature, for what concern the structural and functional organization of the human body*) was delivered during the first two years (years 1 and 2 of primary school), and was dedicated to the environment, environmental problems, and basic concepts of functional anatomy, approached as *"perceptible" anatomy"*, aimed to make pupils to gain awareness of specific experiences of everyday life, as well as of their own body through simple classroom experiments based on the direct observation the human body.
The Modules given during this early part of the programme were:

first year:
- Module 1. *The Environment and Us* (concept of environment and conditions of environmental well-being);
- Module 2. *The human body and movement* (general conformation of the human body and perceptible human anatomy of the musculoskeletal apparatus);
- Module 3. *Relationship and exchange between the human body and the environment* (what goes in and what comes out).

second year:
- Module 4. *The heart and blood vessels* (functional and perceptible anatomy of the cardiovascular apparatus);
- Module 5. *The brain* (the journey of signals).

The second part of the programme (*learning through an experimental approach the fundamentals of body functions*) has been delivered during the third and the current fourth year, by further developing previously treated topics.

third year:
- Module 6. *The senses* (functional and perceptible anatomy of our sense organs);

– Module 7. *A journey into the knowledge. The executive mental functions.* (the brain, is responsible for the central coordination of all complex activities of the organism).

fourth year:

– Module 8. "*The brain and its networks: external with the environment, and internal with the rest of the body*" (a revision and consolidation of the pupils' understanding of problems concerning the environment, and networks)

– Module 9. "*Travelling through a world that cannot be seen, from the organism to the cells and to the molecules*" (transmission of elementary, basic knowledge regarding the structure and function of the cell, the tissues, the molecules and the energy).

The third and final part of the program (*becoming aware of health risk factors and learning how to counter them*) has been developed during the fifth and last year of primary school on the basis of what had been learned during the previous four years. The topics considered in the modules are reported in this booklet and are summarized below.

- Module 10. *The flow of energy from the sun to food, food as a source of molecules and energy*. The Module is designed to let pupils understand that our body is made of the same matter that forms the food, that is *organic substance*, appropriately transformed by our organism according to the specific characteristics of our species.

- Module 11. *Risk factors and mechanisms of defence by the organism and the environment.* This module has been divided into five *mini-modules* that address the main risk factors and the related protection factors.

- *Introduction*
- *Accidental risks and how to prevent them*
- *The infectious risk and the body's defences*
- *Too much and too little, the "imbalance risk" in the diet, in physical activity and in the sleep-wake rhythm*

- *From anger to violence*
- *Addictions, feel good and be free*

3. Activities carried out in the previous phases

In the preliminary phase of the project the following activities were completed:

– elaboration of the general project for the Accademia Nazionale dei Lincei;

– presentation of the project for evaluation and discussion at a national (Accademia dei Lincei, Accademia Medica di Roma) and international level (the executive committee of the *InterAcademy Partnership for Health*);

– presentation of the SCIESA project to the Fondazione Terzo Pilastro - Italia e Mediterraneo that co-financially supported the programme together with the Accademia Medica di Roma for the first and third years of activities),

– definition of an agreement protocol with the Regional Education Authorities of Lazio for the implementation of the experimental project in a primary school of Rome;

– definition of an agreement protocol with the Istituto Comprensivo Luigi Settembrini for initiating the activities in four first-year classes located in Rome (Via Asmara and Via Novara) and for their continuation for the entire five-year primary school period.

MODULE 10
THE FLOW OF ENERGY FROM THE SUN TO OUR FOOD
Food as a source of molecules and energy

Identifying and exploiting episodes of everyday life; sharing of the pupil's direct experiences

During delivery of the Module, the teacher will refer to the pupil's experience. *"How does our organism tell us that we need to drink or eat?", "Do you remember what happens to the food we eat?", "What changes occur to food in the mouth? And in the intestines?", "Why do these changes happen? What are they meant to do?", "What happens to those small units (molecules) that are produced from the digestion of food?", "What happens to those parts of food that are not digested and absorbed?", "Where do we get the energy that we need to live and work?", "What are sources of energy?".*

EXPECTED LEARNING OUTCOMES

- The food that we eat is digested and the small molecules that are produced are absorbed, *enter circulation and are distributed throughout the organism via the blood vessels. The* same molecules derived from food can also be used to form the molecules that make up our bodies. Therefore, our bodies are made of the same stuff as food that we eat is made on, that is *organic compounds*, that are appropriately transformed according to the specific properties of our species, that are coded in the nuclei of each cell. A dog or a cat eat much the same things we eat, but their cells are coded with a different developmental project, which takes them to become a dog or a cat.
- These transformations of organic substances are possible, given that in the animal and plant kingdom, organic compounds are made up of the same atoms (*carbon, hydrogen, oxygen*, and

nitrogen), which are organised to form the three molecular families typical of organic compounds: proteins, sugars, and fats.

- Organic compounds originate in the plant kingdom. Plants are capable of synthesising organic molecules starting from the above four atoms and, to do this, they use solar energy.
- Animals (humans included) are not capable of this type of synthesis and therefore depend on their nutrition and survival on plants and/or on other animals, which in turn have fed on plants.
- Nutrients are assimilated to supply molecules that are transformed by our bodies and are used for our *vital functions,* which are those activities essential for our survival and carried out continually by our bodies (e.g., cardiac and respiratory muscular activity, thermoregulation) as well as for *growth, physical activity, mental activity,* and *storage of energy reserves.*
- Once food is digested, it is *completely* absorbed and not in function with the necessities of the organism. This means that nutrients can be absorbed in excess or in defect of what is needed for growth, physical activity, mental activity, and energy reserves storage. When excess food is ingested, abnormal quantities of energy reserves are stored, especially in the form of fat. On the opposite, insufficient ingestion of food leads to an insufficient quantity of energy to be provided for growth, the functioning of the organism, and to scarcity of energy reserves.

SUBJECT MATTER

The teaching objectives of each section of the modules are indicated below (in **bold**, the concepts or notions to be transmitted; in *italics*, the experiences to be used in the inductive teaching activities).

1. The origins of the molecules that make up our bodies

The food that we ingest from the external environment is the source of the material ~~from which~~ we are made of. This is known as *organic matter:*.

- *Ask the pupils if they remember the experiments from the Module "What Comes In and What Goes Out" explaining the processes of digestion and absorption* (breaking up dry bread in a mortar;

passing crumbs through a sieve; coloured stuff filtering through a tea bag in water, etc).

- *Ask the pupils what they remember about the Modules on heart and blood vessels, and on the cell*, to discuss how substances are absorbed and then distributed throughout the organism to reach every single cell; how they are absorbed through the cell membrane to be used by the cell.
- *The cells of our organism use the absorbed molecules to make different, species-specific molecules* using an "instruction manual" which is located in the cell nucleus.
- *The substances that are formed by our organism are the same as those present in food, and are called organic substances.*

The molecules that form organic substances belong to three fundamental classes and are made up of the simplest elements — atoms — that are always the same in all living matter.

- *Can you remember what cells are made from?* Discuss with the pupils that the cells, although very small, are made up of even smaller units, invisible even with a microscope, known as molecules.
- *Ask the pupils if they can remember the names of some molecules*.
- *Show a three-dimensional model of a molecule* (**see Teaching support materials**) to highlight how these are made of even smaller units known as *atoms*. *Verify if the pupils understand that approximately 98% of organic substances are formed from four elements only: carbon, (C), hydrogen (H), oxygen (O), and nitrogen (N). Verify that the pupils understand that these same elements are present as molecules in water (H and O), in air (N, O, and C) and in the soil (N). In addition to these four elements, organic substances also contain minor amounts of other elements such as phosphorus (P), and sulphur (S).*
- In organic compounds, these elements form molecules of various dimensions which belong to three main categories: *sugars, fats, and proteins.*

Animals (man included) are unable to feed themselves directly from these molecules present in air, water and soil, and so, they have to feed from already formed organic molecules.

- *Can we live from water and air? Is it sufficient only to breathe or drink to live?* No, we also have to eat. *Can we eat anything to live, e.g. small stones or soil?* No, we can only eat food produced by other organisms, food that already contains proteins, fats, and sugars. As an example, proteins are found in meat and in pulses, sugars are found in bread and pasta, fats are found in milk. We cannot live only from air and water because we are unable to build organic matter by directly using the elements found in air or water. *Explain to the pupils that animals are incapable of forming organic substances with an analogy:* it is not sufficient to have the various pieces of an engine to be able to build it. We also need screwdrivers, pliers, spanners and other tools to put the various pieces together, as well as the energy necessary to carry out this task. *Discuss this analogy with the pupils to lead them to the conclusion that animals – humans included – do not have the necessary tools* to build the molecules that form their bodies starting directly from oxygen, carbon dioxide and nitrogen (present in the air) and water.

The organic matter in our food is produced by the vegetable kingdom

- *What organisms are capable of producing organic substances?* Let us try and understand this by analysing what our food is made of. *What is the flour that the baker uses to make bread made of?* (starch, a type of *sugar*). *And where does flour come from?* From wheat. So, from a green plant. *Repeat the same reasoning for olive oil* (*fats*). Even some of the proteins that we eat are derived from plants (e.g. those found in pulses). If a pupil suggests that we also get protein from beef, or chicken, ask them another question: *"What do chickens or cows eat to become big and fat and give us the meat that we eat?"* If necessary, add some more examples to conclude that our food originates always, directly or indirectly, from green plants (*see Teaching support materials*).

- Differently from animals, green plants are able to form organic molecules, particularly carbohydrates, fats and proteins because they know how to directly use carbon dioxide, water and nitrogen. *And where does this capacity come from?* Because plants have a toolbox of instruments and also the energy needed to carry out this synthesis; they are able to capture energy contained in sunlight through a complex mechanism called chlorophyll photosynthesis (*see Teaching support materials*).
- *Ask the following: "When you sit in the sun, do you feel anything that makes you think that sunlight can actually bring energy to the Earth? E.g., what difference do we feel when sitting in the sun or in the shade?"* Guide the discussion to the conclusion that sunlight is a form of energy (*thermal energy* when it warms us up). This is easily and intuitively demonstrated by watching how the sunrays can create movement (by the use of a *Crookes radiometer*). Another simple demonstration can be made using a solar cell that transforms solar energy into electrical energy. (*see Teaching support materials*)**.**
- *Is it true that solar energy is really indispensable for plants to grow, and so that they can create the new organic matter that we use as food?* Can we prove this by an experiment? *Can we make a bean plant grow without light?* Verify this with an experiment on how plants grow in scarcity or absence of light (*see Teaching support materials*).

The energy contained in sunlight is used by plants to synthesise organic molecules, generally sugars, starting from inorganic molecules (carbon dioxide and water). Plants then use the energy they have stored in sugars to construct the other molecules ~~that~~ they need (protein, fats, DNA, etc.). Other elements necessary to form *organic substances*, such as nitrogen, phosphorus, and sulphur reach the plant from the soil through the roots.

Plants are therefore *producer organisms* of organic matter

- *Producers and Consumers*: *Food chains. Discuss again with the pupils on the sources of our food to reach the conclusion that it all derives directly from plants when we eat plants, and indirectly*

when we eat meat which is derived from animals who in turn feed from plants and/or other animals (the pupils should now understand about the existence of <u>food chains</u>, see *Teaching support materials*).

- Animals are *consumer organisms* but not *producers* because they are not able to synthesise organic substances; these are produced by plants. Along the food chain – "who eats who" – there is a flow of energy that starts from the sun and passes to the producer organisms (who use it to produce organic substances) and is then passed on to consumer organisms.
- *Together with the pupils, try to identify a food chain in a biological community (an "ecosystem") of their choice* (write their suggestions on the whiteboard and ask them to make notes in their SCIESA workbook).
- <u>*Food networks*</u>. *Get the pupils to discuss that in all ecosystems, most food chains are not separated linearly but are very often interconnected.* To obtain food necessary for growth, usually consumers can feed from a wide range of producers and also from other consumers, and in turn, this consumer can be used as food by a variety of other consumers. Thus, during the flow of energy along the food chain from organism to organism (from a wide range of producers to an as wide range of consumers) there are multiple interactions that create a complex <u>networks</u> of food chains rather that a single linear <u>food chain</u> (*see Teaching support materials*).

2. The use of energy present in foodstuffs

BACKGROUND INFORMATION FOR THE TEACHER

<u>*Energy, force and work.*</u> The concept of *force* is strictly connected to the concept of *energy,* but they are different entities. A body that contains *energy* can use this to develop a *force* that can be used to complete a work. For example, fuel in a petrol tank of a car contains *energy* (*chemical*); the explosive combustion of petrol that takes place in the engine liberates energy to develop *force* that can be used to carry out a work (*movement of the car*). It is easy to understand that chemical energy contained in the fuel can be transformed into kinetic energy (movement). Also to be noted: if we simply burn the fuel, instead of using it to create movement in an engine,

we will still have a transformation of energy: *chemical energy* is transformed into a *flame* that in turn produces heat, ~~or~~ *thermal energy*. If during fuel combustion we measure the quantity of heat developed, we can easily get to know the quantity of energy contained in fuel, which can be measures in units known as *calories*.
Also in the case of muscular contraction, a release of *chemical energy* allows the muscle to generate a *force* that can be used to complete a work, e.g. lifting a weight.
Exothermic and endothermic reactions. Experiments will be conducted in this Module to demonstrate that a chemical reaction – not only those that take place in our bodies, but simply dissolving salt in water – can liberate energy or require energy, depending on the salt used. In the first case, we talk of *exothermic reactions* (water heats) and in the second case, we talk of *endothermic reactions* (water cools). The explanation of this phenomenon is based on the difference between the quantity of energy necessary to break the bonds that hold together the ions forming the crystalline structure of the salt ("*Energy of the salt crystal*") and the energy needed to join the ions of the salt to the water molecules when in solution, i.e. when separated from each other in the aqueous solution ("*Energy of hydration*"). If the balance of these two conditions is positive, i.e. energy of the salt crystal (holding together the irons in the crystal) is greater than that of hydration, the process of dissolution needs energy to be completed; this energy is taken from the surrounding environment (thus, the final solution will be colder than at the start). When this balance is negative, meaning that more energy is liberating when dissolving the ions in water than the energy binding the ions together in the crystal, then excess energy is produced which is released into the environment and so the final solution will be warmer.
A simpler explanation of this phenomena to give to the pupils is given in the supplementary material for the experiment on exothermic and endothermic reactions in the *Teaching support materials* at the end of this Module.

Organic substances contained in food are used by the organism to carry out its functions

- *To introduce this topic to the pupils, we can go back to the questions at the beginning of this Module: "Do you remember what happens to the food that we eat?", "What changes happen to food in the mouth?", "and in the intestines?", "Why do these changes take place?" "What is their purpose?" Develop these concepts to lead the pupils to*

the conclusion that the organic compounds that we eat undergo a series of transformations in our bodies, taking to the synthesis of the large and small molecules present in our organs (muscles, skeleton, brain, etc.). Let's imagine that food is like constructions made out of Lego® blocks, e.g., a house. Dismantling the house, we can obtain single blocks to build completely different objects, such as a toy car. Likewise, our organism can dismantle the molecules in the food we eat, and the cells in our organisms are able to use these molecules to make their own specific molecules, following the instructions that are coded in their nuclei. The newly synthesized molecules are used by the cells to grow and divide, thus increasing their numbers and consequently, the overall dimensions of the organism. These same molecules are used by the cells for their own functioning (sending signals for neurons, contraction for muscular cells, etc.). In sum, once absorbed, the molecules derived from food are used by the organism for *growth*, and for *maintaining its vital functions* necessary for life, such as thermogenesis, respiration, cardiovascular activity, etc.; as well as for mental and physical activities. What is not used for these activities, it is *accumulated in deposits*.

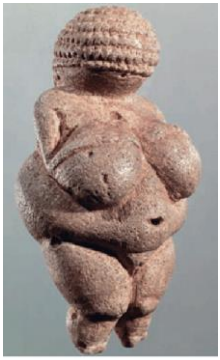
In our organisms organic molecules – proteins, sugars and fats – have preferential locations and undertake different functions

- *To introduce this topic we can take advantage of knowledge acquired in previous Modules*. Proteins are large molecules (*macromolecules*) made up of chains of smaller molecules known as amino acids (the pupils have seen a 3-D model of glycine). *Glycogen* is another macromolecule which is made up of branched chains of the simple sugar *glucose* (the pupils have seen a 3-D model of glucose). The diagram to

be provided to the pupils also shows a fragment of DNA, another macromolecule formed by the aggregation of small molecules known as *nucleotides,* that contains the information necessary for the construction and functioning of the organism. (*see Teaching support materials**:** diagram of 3D-models of macromolecules*). *Proteins* are widespread throughout the organism and are well abundant in certain organs such as the muscles. *Fats* are used to form cell membranes and are found throughout the organism, but they are particularly abundant in body fat (adipose tissue). Sugars are also found throughout the body and tend to accumulate in the liver and muscles where they are organised in the form of large molecules of *glycogen*.

- *The main function of proteins is structural, and they are found in the skeleton, skin and tendons. Indicate to the pupils how our bones, tendons and skin are robust and resistant to traction,* and this is due to the presence of *collagen, the most* abundant protein in our organism. It is important that sufficient protein be assimilated through food when our bodies are growing. *Proteins are also responsible for muscular contraction. Proteins have regulatory functions as well, and can take on the role of tools to break down and construct the organic molecules in our bodies.* (Refer to the previous example on the assembly of a toy car, proteins being the tools used in such molecular operations).
- *Discuss with pupils the functions of fat or adipose tissue that, in addition to the modelling of our bodies, it helps maintain our body temperature: as most fat is distributed immediately below the skin, it acts as a thermal insulator.* Refer to the abundance of adipose tissue in some animal species that live in cold climates, such as bears and whales. Also discuss the diverse distribution of adipose tissue between the sexes, and how this contributes to *sexual*

dimorphism. But its most important functional role is that it constitutes the organism's main *store of energy* as it is capable of releasing a great quantity of calories per mass unit. The calorie is a measure of energy liberated by the combustion of a substrate (the calorific value of a gram of lipids is approximately double that of sugars or proteins). Discuss with the pupils that many thousands of years ago, when humans had difficulty in finding food and were not able to store it, the role of energy stores in the form of body fat was particularly important for survival. In those times a greater quantity of body fat increased the chances of survival. Let the pupils see that in ancient times obesity was considered as a valuable asset, so much so that it is represented in the *Venus of Willendorf* figurine made about 25,000 years ago in the Palaeolithic period, shown here. Ask the pupils if they think energy reserves are still as important as they were thousands of years ago.


Venus of Willendorf

- Simple sugars such as glucose are *a direct source of energy* for the organism. When glucose is oxidised, it liberates energy. Sugar deposits in the liver and muscles represent an important energy reserve in addition to the fat deposits in the organism, but can be used much more rapidly.

The organism takes from food the energy needed for its functions, after storing it in the form of small molecules

- *Why is it that we need to breathe and eat to survive? As we saw in the Module on the Cell, chemical energy contained in the food that we eat is liberated by our organism through a process of combustion. This phenomenon is similar to what*

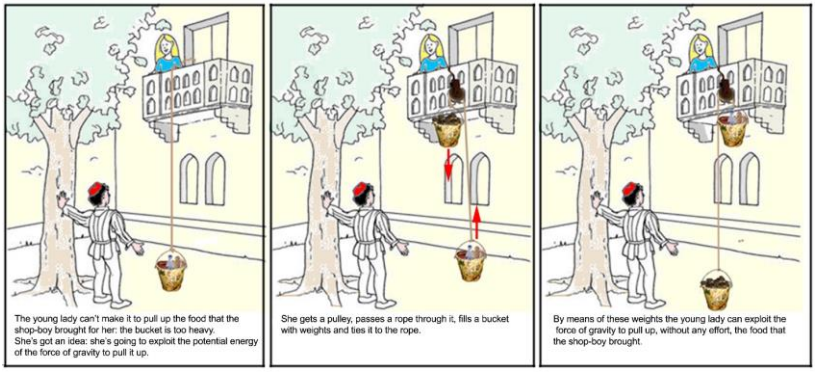
happens to other substances – called fuel – that can be ignited to liberate into the environment the energy they contain as fire, light and heat. Food also acts like a *fuel,* as when it is "ignited" it burns up more or less completely. Our cells, however, are not able to support great quantities of uncontrolled heat, as they would die or be burned. For this reason, our cells have mechanisms that are able to release small doses of energy contained in food, and each of these doses are packaged and stored in molecules of ATP. We must remember that the process of combustion not only needs fuel but also oxygen. The metabolic processes of living organisms – which are primarily a type of combustion process that takes place 24 hours a day – require oxygen, that has to be introduced from the external environment by continual respiration, because our body cannot store this gas. Without oxygen any type of fire would be extinguished and similarly, long periods without breathing causes the death of the organism, because after a short period of time its cells have no energy left to carry out their activities. The phenomenon of intracellular combustion liberates energy, but without any flame, because energy is released in a controlled and gradual manner; at the same time, waste products are produced and eliminated, carbon dioxide through expiration and water through the kidneys and by sweating.

- As we said before, the chemical energy contained in food is captured, transferred and accumulated in the form of molecules of ATP, small molecules that contain the only form of potential energy that our cells are capable of using to carry out their functions. Splitting in two parts, ATP liberates the energy stored in the bonds that link together the two parts of the molecule and this chemical energy is used to carry out a vast number of biological functions. For

example, signals can be transmitted along nerves because the energy stored in ATP ~~which~~ is used to produce an electrical signal which travels along the nerves; muscular contraction depends on the transformation of chemical energy contained in ATP into mechanical energy; the synthesis of macromolecules in our bodies requires an input of energy (See Module on the cell). The release or absorption of energy during chemical reactions can be easily demonstrated by an experiment of dissolving salts in water which can generate or absorb heat depending on the type of salt used (*see Teaching support materials Exothermic and Endothermic reactions*).

- *The activity that follows aims to clarify the meaning of energy, force, work: ask the pupils to rub their hands vigorously. What happens? (the hands heat up). Why?* We have used the *chemical energy* present in the form of ATP in our muscles to generate *muscular force* that we used to produce *work*: we rubbed our hands together. The friction created when rubbing our hands eventually generated thermal energy (heat on the hands). After a short while, the hands are not warm any more. *Where did the thermal energy go? Has is disappeared?* (no: it was distributed into the environment and is now present in the environment).
- *We are now going to do a second experiment, in which we are going to use the chemical energy contained in our muscles to lift a weight. Where has the chemical energy that we have used to lift the weight gone?* It has been transformed into *gravitational energy*, that is, energy that is linked to the position of the weight in space. In other words, we have increased the gravitational energy of the weight. To prove this, we all know that if the weight were to fall on our foot, it would hurt more if it fell from a greater height. (In these two experiments, we note that one form of energy –

chemical, contained in the muscle – can be transformed into other energy types: thermal, kinetic).



Energy derived from food can be used directly or stored in energy stores

- Eating is necessary to supply the organism with energy, that can either be used immediately or stored in our energy reserves (deposits of sugar in the liver and muscles, and fat in adipose tissue). Using energy stored in the form of sugars or fat also requires their transformation into ATP molecules.

Our organism is capable of maintaining our internal conditions stable

- *Is our body the same temperature as the school desk? Touch your forehead and then a nearby object. Are they the same temperature?* (No, my forehead is warmer than the desk). *How does our body keep warm? Where does the heat come from, that keeps us warm?* Like all the energy that our bodies use to carry out its functions, also the heat that keeps us warm comes from the combustion of food. At this point we must clarify that only about half of the energy liberated by breaking the bonds in the ATP molecules is used; the other half is dissipated in the form of heat that contributes to

maintain our body temperature at 37°C, which is then dispersed into the environment through the skin.

- The temperature of the environment around us is not always constant. If we go out of the house in winter, we pass from a warm to a cold environment. Even if parts of our bodies are not covered and they become cold, the internal temperature of our bodies will remain at 37°C. We can easily verify this by putting a hand under our armpits. Despite any modifications that take place in the external environment, our organism is still able to maintain the internal environment at a constant temperature, just like other characteristics inside us are kept constant, e.g. the quantity of water, of oxygen, and of carbon dioxide. The fatty layer of adipose tissue also helps in this process.
- *A typical example of a mechanism that stabilizes a characteristics of our internal environment is how the body temperature is kept constant. Ask the pupils to answer some questions regarding how does the organism manage to maintain its body temperature constant. What happens when it is hot outside?* (we sweat). *And when it is cold?* (we shiver). *Discuss these questions to lead the pupils towards understanding the thermostatic processes described below*. The brain has nervous centres able to regulate the temperature of our blood and body. If the external temperature increases and consequently body temperature also tends to increase, the organism activates *sweating* mechanisms and also *dilation of the superficial blood vessels*, two reactions that facilitate the dispersion of heat and tend to bring the body temperature back to normal values. On the contrary, if body temperature begins to drop because of a cold external environment, our organism activates mechanisms to conserve heat through the *constriction of superficial blood vessels* and the production

of heat through *shivering*, which is nothing more than repeated muscular contraction. Our organism is not only capable of maintaining body temperature constant, but also other characteristics of its internal environment such as the quantity of water, of oxygen, of carbon dioxide, and many more.

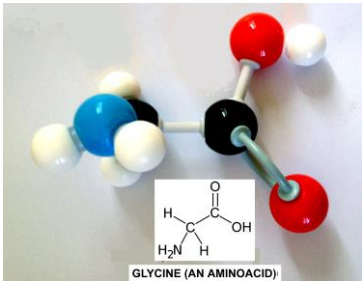
- Ask the pupils questions regarding how the organism signals the need to eat or drink, and why this is so. What happens at lunchtime? What feelings do we have? (we feel hungry). Discuss these questions to explore the mechanisms that regulate the quantity of food and water that we ingest.
- Also hunger and thirst are sensations aimed at maintaining optimum levels of energy, of nutrients and of water in our bodies. Indeed, our brain has various mechanisms that regulate the quantity of food to be eaten in function of the amount of energy consumed. The organism establishes a base-level of energy to be generally available, below which the nervous centres signal the sensation of hunger and, above which, a sensation of feeling full. If the response to these signals is balanced, we eat the right amount of food for the work that our body has to carry out, and the organism is in equilibrium as it gets all it needs to continue to function and grow. On the opposite, if the response to the hunger stimulus is not balanced and we eat an excessive quantity of food (it should be considered that food, even if taken in excess, is nonetheless all digested and absorbed) the organism can still achieve equilibrium by consuming excess energy through *increased physical activity*. If, however, there is insufficient physical exercise to compensate for the nutrients absorbed in excess, these are transformed into fat, which is stored in fat deposits. In the opposite case, in which insufficient food is ingested, the organism has to use some of the accumulated stores of energy, until these are depleted

if food assumption continues to be scarce (*see Teaching support materials: Diagram on utilisation of food*).

- If, for a long period of time, more food is eaten than it is necessary, the regulatory system that we mentioned before is "readjusted", and the threshold for satiety increases. This means that the organism continues to feel hungry even when sufficient food has been ingested. This malfunction of the regulatory process is often the cause of *obesity*. In the opposite case, when food is voluntary not eaten for a long period of time, the mechanism regulating the amount of food to be ingested is not readjusted and the person continues to feel hungry, but will not eat. Such serious alimentary pathology, *anorexia,* is due to a specific mental pathology.

TEACHING SUPPORT MATERIALS

Molecules are made up of atoms

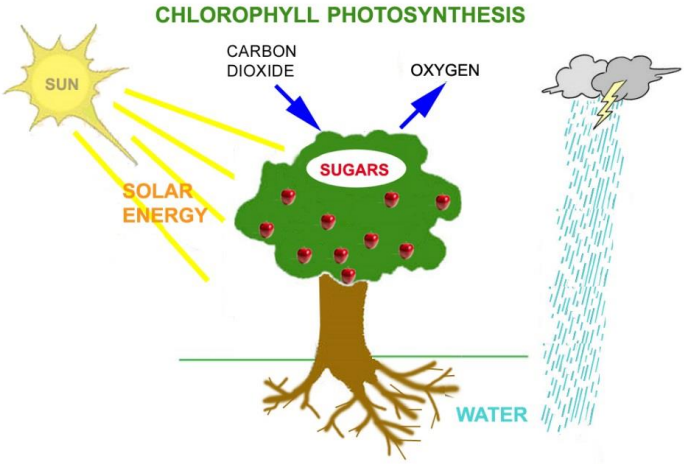


Required materials: Kit to build 3-D models of molecules already used in Module 9. Show these 3-D models of *molecules* to highlight how these are made up of even smaller units: the *atoms*. The preassembled models provided are of *water*, *sodium chloride* (a salt), *glucose* (a sugar), and glycine (an amino acid). In the kit, atoms are differentiated by colour, each atom representing an element. Make sure the pupils note that i) the atoms are held together by bonds to form *molecules*; ii) four elements (C, H, O, N) are commonly found in the organic molecules:. In these models, *carbon* (which is indicated by the letter **C)** ~~and~~ is coloured *black*; *hydrogen* (indicated by the letter **H**), is *white*; *oxygen* (indicated by the letter **O) is** *red*, *nitrogen* (indicated by the letter **N)**, is blue; iii) all these elements are contained in water and air.

Where our food comes from

All our food is derived directly or indirectly from green plants. Examine the photographs: flour from wheat, chicken from corn, and oil from olives.

Solar energy allows plants to synthesise sugars



Chlorophyll photosynthesis is a chemical process by which green plants produce organic compounds, mainly sugars. With the help of chlorophyll present in leaves, during photosynthesis solar energy allows green plants to synthesise a sugar (glucose) from carbon dioxide and water; this molecule is necessary for the plant's life and it is used also to make other organic substance. Chlorophyll photosynthesis is the primary process on Earth for the synthesis of organic compounds from the inorganic world.

Solar energy and how to understand it

The *Crookes' Radiometer* has four vanes; each vane has a white-coloured face and the opposite one is black. These are contained within a glass bulb with a good vacuum, and the vanes can rotate on a perpendicular axis with minimum friction. *When the radiometer is illuminated with sunlight or from any other warm luminous source (incandescent light), the vanes start to turn.* The more intense the light, the more rapidly they turn.

Crookes' radiometer

Plants need light

Growing a plant in class can be a simple and very participative experiment; the pupils will understand that light is necessary for plants to grow. No complicated materials are needed. If no sunlight is available for this experiment, then a fluorescent light can also be used, preferably positioned about 12 cm above the growing plants.

REQUIRED MATERIALS

Each group of eight pupils will need the following:

- 16 dry beans left to soak the night before
- 8 dried beans
- access to a magnifying glass
- 4 small peat (or plastic) plant pots (7 to 8 cm diameter)
- 2 plastic or aluminium trays
- 4 small pieces of thin string or wool (approximately 15 cm each)
- 4 paper napkins or paper plates
- 2 cups of moist compost
- 1 spray bottle (approx. 50 ml) or a small bottle
- 1 ruler
- Sheets of paper to note down information on the experiment (see below).

PREPARATION

The evening before the experiment leave the beans to soak (at least 12 for each group of , 4 for each experiment). Each group should also get 4 dry beans.

Moisten the compost before using it: put it in a plastic bag or a container and add water until it is humid. Leave it to soak for at least half an hour in the open container before using.

HYGIENE

Get the pupils to wash their hands before starting the experiment. Clean the work surface with disinfectant at the end of session 2.

PROCEDURE

Divide the class into groups of eight , and in each group identify one *Materials manager*.

Session 1: Observing the dry beans

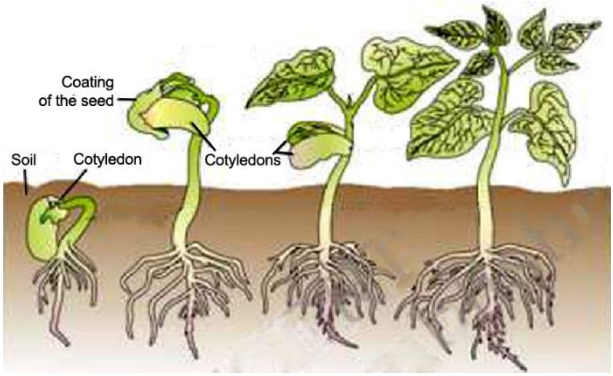
Give each pupil a dry bean and a magnifying glass and ask them to observe it. Each pupil should then make a drawing of the seed on the sheet "SEEDS AND PLANTS". Make sure that all have noted the seed skin and the small depression on one side of the seed, corresponding to where the new shoot will grow from.

Session 2: Observing and planting soaked seeds

1. Give each pupil a soaked seed (placed on a damp tissue) and ask them to examine it; compare it with the dry seed. Ask the following: *In what way is the soaked seed similar to or different ~~to~~ from the dry seed?* Get the pupils to remove the outer covering or "skin" of the seed and separate the two parts inside. They will see two *cotyledons*[1], very small leaves, and the precursor of what will become the root of the plant.
2. Tell the *Materials managers* to collect 4 plant pots and 8 soaked seeds for the group. Ask each group to choose their own name and write this on each plant pot. The pots should also be numbered from 1 to 4.
3. Fill each pot with compost to about three quarters full.
4. On the surface of the compost make two small depressions of about 1 cm, and place one soaked seed in each. Cover the seeds with a little compost. Each group will therefore have 4 pots, each containing 2 seeds.
5. Each group will place their pots on a small tray and will place it near a window in the sunlight, or under a fluorescent lamp.

In the following days...

[1] The *cotyledons* are fleshy embryonic leafs, that give nourishment to the plant when it starts growing and until it develops roots and the first leaves, and so capable of nourishing itself autonomously through photosynthesis.



- Once the seeds have sprouted and the plants are formed, ask the pupils to mark one of the two plants in each pot by tying a little string around the base. *Should one plant die, then they can continue measuring using the other plant in the pot.*
- Tell the pupils to measure the plants in each pot every day (or every second day) and ask them to write the results on the sheet SEEDS AND PLANTS.
- Ask the pupils to water the plants every 1-2 days with a little water (the compost should be kept humid but not wet).

Session 3: Experiment with light

1. When most of the plants have reached a height of ~10 cm, explain to the pupils that they are now going to study the effect of light on the growth of the bean plant. Ask the following: *What do you think will happen if we give the plant less light?*
2. Each group will now move pots number 3 and 4 into a previously identified place with less light (at the back of the classroom, far from a window or light source). Ask: *Do you think that these plants will receive as much light as the others? Why is this so? What do you think will happen to the plants that receive less light?* Let the pupils discuss the

possible effects and get them to write their ideas in the SCIESA workbook.

3. The pupils will continue to measure the height of the plans for another 3 to 5 days and write these results on the sheet "THEY ARE GROWING".

Session 4: Examining the data

1. After the pupils have made their final measurements, ask them to respond to the questions on the sheet "THEY ARE GROWING".
2. Discuss the results with the pupils. They should be able to reach the conclusion that the differences observed in the plants are due to the differing availability of light. Help them by asking: *Were the plants the same height before we moved pots 3 and 4 away from the light? Now are they the same height? What do you think caused this difference? Can you see any other difference apart from their height?* Help the pupils reach the conclusion that the difference in growth (the plants with less light will have grown less and will be long and thin) and the colour (plants with less light will be a pale green) is due to the differing availability of light. *What was the only difference between the two groups of pots?* (the only difference was light, all other variables in the experiment — water, compost, seeds, pots, the way the seeds were planted — were the same for each group).
3. Ask the following: *Where do you think the plants in pots 1 and 2 were able to get the energy to produce a better stalk and more leaves? What was missing in pots 3 and 4. What you think will happen if we put pots number 3 in 4 back in sunlight?*

We could also ask the pupils other questions to make them reason more on the experiment, such as:

How can we change this experiment to observe the effects that different quantities of water will have on growth? What if we were to add fertiliser?

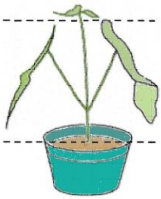
Seeds and Plants

USE THE FOLLOWING SHEETS TO RECORD YOUR OBSERVATIONS ON THE PLANTS

Draw a dry seed

Draw a soaked seed

Draw what is inside a soaked seed



Measure the stems from ground level to the tallest leaves

TABLE OF MEASUREMENTS (in mm) OF THE GROWING PLANTS

Date	POT 1		POT 2		POT 3		POT 4	
	marked plant	unmarked plant	marked plant	unmarked plant	marked plant	unmarked plant	marked plant	unmarked plant

THEY ARE GROWING

What will happen if some plants receive less light than others?
Make suggestions and write them in your SCIESA workbook, and then carry out the experiment:

After moving pots 3 and 4 to a place with less light, continue to observe and measure (in mm) the plants in all 4 pots. Record your measurements in the following table.

Date	SAME LIGHT				LESS LIGHT			
	POT 1		POT 2		POT 3		POT 4	
	marked plant	unmarked plant	marked plant	unmarked plant	marked plant	unmarked plant	marked plant	unmarked plant

At the end of the experiment, answer the following questions:

1. Describe the final appearance of the plants in pots 1 and 2

_____

_____

2. What is the average height of the plants in pots 1 and 2? ….. mm

3. Describe the final appearance of the plants in pots 3 and 4

_____

_____

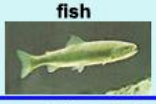
4. What is the average height of the plants in pots 3 and 4? ….. (in mm).
5. Have you noticed any differences between the plants that received more light and those that received less? How could you explain the differences that you have seen?

_____

_____

Food chains

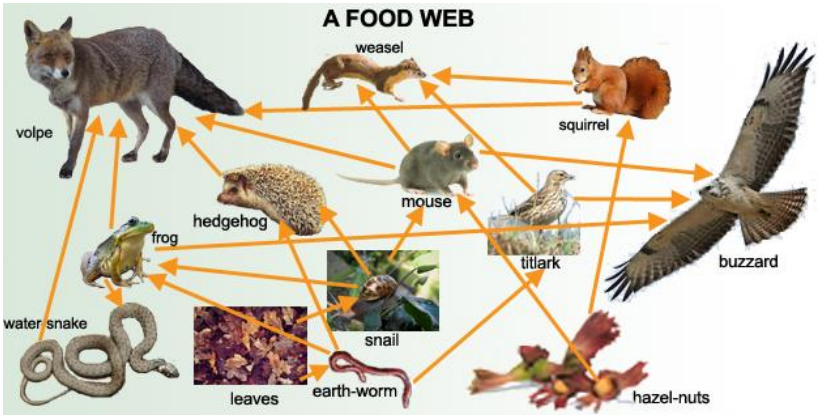
EXAMPLES OF FOOD CHAIN

	Marine ecosystem	Freshwater ecosystem	Grassland ecosystem
Primary producer	phytoplancton 	algae 	grass 
Primary consumer	zooplancton 	insect larvae 	insect 
Secondary consumer	fish 	fish 	mouse 
Tertiary consumer	humans 	predatory fish 	owl 

N.B. Organisms that are transported by water are known as *plankton*; this includes algae and photosynthetic bacteria (*phytoplankton*) and animals unable to swim or too small to oppose the current (*zooplankton*).

Food web

Discuss with the pupils the complexity and variety of food webs, that offer a variety of food sources and which means that we do not depend on one specific source of food.

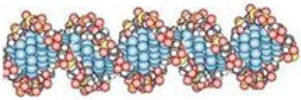


Organic compounds contained in food are assimilated by the organism so it can carry out its functions

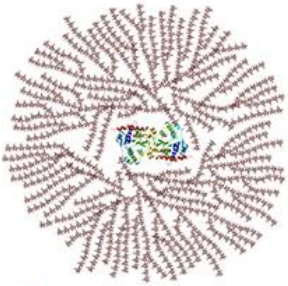
- Remind the pupils what they learned when studying the cell, the difference in dimensions between the atom, molecule and cell (give the pupils some real examples).
- Ask the pupils if they remember experiments from previous years on basic aspects of the digestive system and of the process of absorption (breaking down dry bread in a mortar, passing crumbs through a sieve; coloured liquid filtering through a tea bag in hot water, etc.).
- Ask the pupils if they remember what they learned in the module on the cardiovascular apparatus and on the cell, getting them to discuss on how substances are assimilated and distributed in the organism to reach each cell, and how they are absorbed through the cell membrane to be used by the cell.

Macromolecules in organic matter

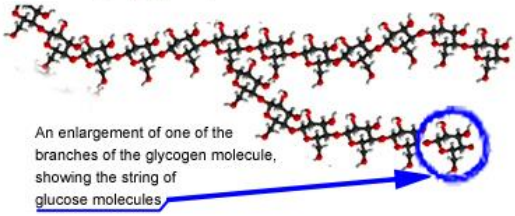
Small molecules (amino acids, sugars, nucleotides, but not lipids) can aggregate to form gigantic molecules known as *macromolecules,* such as the ones illustrated below.



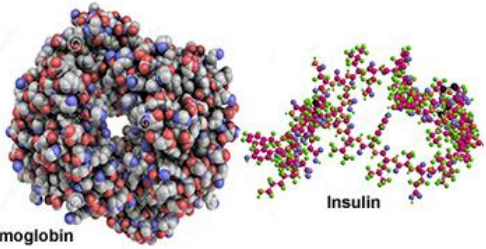
Part of a DNA molecule
DNA molecules, that are located in the nucleus of cells, contain all the ncessary information for building an organism and for its functioning. A DNA molecule is formed by very long sequences of small molecules called *nucleotides*



A glycogen molecule
Glucose molecules that are absorbed by the organism may be used as such, or may be linked to many others to form this huge, ramified, macromolecular complex that is stored by the organism, and is to be used as an important energy reserve.
(drawing taken from *Wikimedia Commons, the free media repository*)



An enlargement of one of the branches of the glycogen molecule, showing the string of glucose molecules

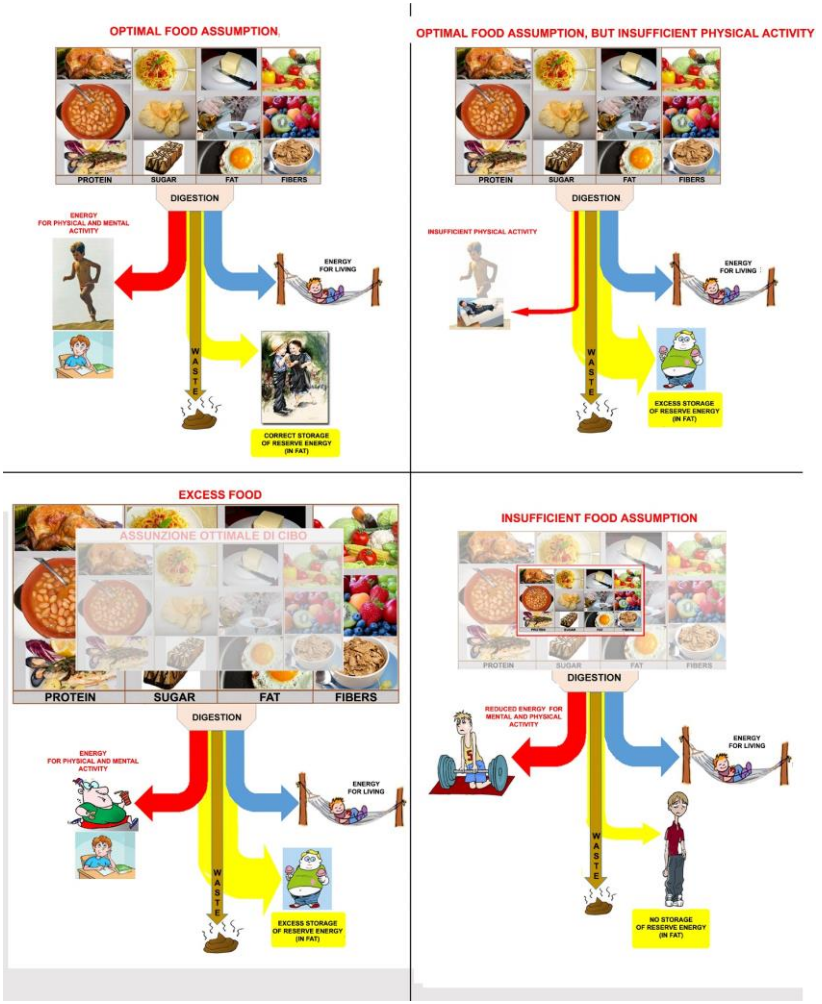


Insulin

Hemoglobin

Two proteins, each made by chains of aminoacids. *Hemoglobin* is contained in red blod cells and binds oxygen. *Insulin* is a protein that regulates sugar concentretion in blood

Diagram of absorption and use of food



The four images in this table show how a correct alimentation and adequate physical exercise can prevent obesity or excessive low weight, both potential causes of pathologies.

Exothermic and endothermic reactions

The experiments proposed are aimed to demonstrate that a chemical reaction, not only those that take place in our organism, but also the simple dissolution of a salt in water, can liberate energy or may require energy depending on the salt that is used. In the first case, we speak of an exothermic reaction (water heats) and in the second case of an endothermic reaction (water cools).

How to explain this phenomenon to the pupils: The components of a salt (e.g. chlorine and calcium in the case of calcium chloride) are held together by strong electrostatic bonds. When we add water to the salt, the molecules of water break these bonds holding ~~the sodium~~ chlorine and calcium together (they become "hydrated") and pass in a solution. Breaking bonds requires energy, whereas hydration liberates energy. If the energy needed to bring these bonds is less than the energy gained from hydration, the excess energy will be transferred to the water in the form of heat. Oppositely, if the energy needed to break the bonds is greater than the energy liberated from hydration, then required energy will be taken from the water, making it colder.

The following experiment shows two different reactions, one exothermic and one endothermic, using two different salts:

Calcium chloride: dissolving 1 gram in about 10 ml of water, we can observe a 15°C increase in water temperature.

Ammonium chloride: dissolving 2 g in 10 ml of water, we can observe a 15°C decrease in temperature.

If the water is agitated gently, results can be seen in approximately 10 seconds.

Each group will have: 2 graduated test tubes with the two weighed salts, 1 empty test tube to be filled with water by a pupil for the experiment, 1 thermometer.

- Start with calcium chloride ($CaCl_2$). Measure the temperature of the water that is going to be used to dissolve the salt: *Ask the following: is it hot?* (no). Explain to the pupils that we will now add the water to the salt and we will see what happens when it is dissolved. Add approx. 10 ml of water to the test tube with

calcium chloride, place a stopper on the test tube and shake gently for approx. 10 seconds until the salt dissolves. Remove the stopper and measure the temperature of the solution. The pupils will see that the temperature has increased by approximately 15°C. Where has this heat come from? Let the pupils make hypotheses (the heat has come from breaking the bonds in the salt which then passed into the water).

- Now repeat the experiment with ammonium chloride (NH_4Cl). Same procedure, same questions. The difference is that the water will become approximately 15°C colder. *"If the test tube is colder, that means that energy has been taken away. Where has it gone?"* (The pupils might start to make some hypotheses: The water has given away heat – and so it has become colder – and the heat has been used to separate the atoms in the salt).

MODULE 11
RISK FACTORS AND PROTECTION OF THE ORGANISM AND THE ENVIRONMENT

INTRODUCTION AND BACKGROUND INFORMATION FOR TEACHERS

This is the final module of a five-year educational project. As withprevious Modules, through "working together" and using the methods and knowledge from previous modules, pupils and teachers will identify a series of good practices to promote and maintain well-being and good health. The objective of the SCIESA project is not to impose any lifestyle or model of healthy living but to *stimulate and develop a capacity and understanding to increase awareness of one's own health, and how to approach positively traumas, illnesses, and difficulties that may be encountered in life*. The objective of the teaching activities, therefore, is not to *prohibit* but primarily to assist the pupils to understand and discuss the significance of certain behaviours, even if wrong. The task is therefore to integrate **risk prevention** and the **promotion of well-being** to promote self-development and to improve the children's social, cognitive and emotive skills (defined as ***skills for life*** by the World Health Organisation); a group of abilities required for a proactive approach in dealing with daily life problems and optimising adaptation to the surrounding environment. The sceince of prevention abadons simplistic models such as those arising from a deficit of information to adopt a more complex perspective. Operatively, this project of primary prevention and promotion of health is declined as a process of constructive well-being and based on the valorisation of **resources/defences** more than the prohibition, correction or removal of **risks**. Social well/welfare (emcompassing public health, schooling, pension system, etc.), and personal well-being, that each individual may positively pursue, are strictly intertwined. In this perspective, the process of constructing health awareness/well-being

in schoolchildren should become an integral component of the learning process.

Human development is characterised by continual adaptation between the individual and the environment; this is a dynamic process that lasts the entire lifetime and involves the individual's search for equilibrium. In this scenario, health is not just the *absence of illness*, nor just a state of physical, psychological and social well-being, but an dynamic equilibrium founded on the capacity of the individual (organism – mind/body) to interact positively with the environment, even in front of the continuos varabilities of external circumstances. Well placed by the pupils at the intersection between the **environment** and the **organism** in last year's activity, health is now to be seen as a dynamic process; *a continuum* ranging from optimal well-being to the greatest suffering. By representing health in this way, the individual cannot consider him/herself as being completely sane nor completely ill, and the individual can have an active role in personal health management, e.g. *by adopting a correct lifestyle and appropriate preventative measures*. It is also to be considered that life experiences, as well as illnesses, can alter the well-being of the individual to different degrees depending not only on the type of illness but, even more, on the age of the sufferer. *The construction of health* is a process that not only includes the examination and treatment of symptoms and risks, but also an *appraisal of resources and strategies that favour personal growth.*

The teacher should try and encourage the pupils to reflect on these issues, through reference to their direct experience and to illustrate situations of ill-health or well-being through drawings or written stories.

The capacity of an individual to generate biological responses as well as psychological and social defences that make him able to resist, adapt and strengthen despite adverse environmental or personal factors—is defined as **resilience**. *This is an engineering term and measures the capacity of a material to return to its primitive form after deformation. In psychology, resilience is a set of characteristics and resources that an individual possesses to act proactively towards*

life events, despite any unfavourable conditions or serious risk factors. The concept of resilience obliges us to reconsider projects of promotion of health and also risk factors/protective mechanisms. *Clearly the mere presence of risk factors or protective mechanisms is per se not sufficient to anticipate what consequences that situation will have to the individual. Indeed, not all people exposed to risk present problematic behaviour, and vice versa, not all problematic behaviour is motivated by exposure to risk factors (e.g. consider the relationship between socio-economic conditions and delinquency).*

In this new vision of health, the terms **risk** and **prevention** take on a new significance, and do not only indicate negative or positive physical or biomedical consequences, but all consequences regarding the psychosocial adjustment of the individual. For many years it was commonly believed that well-being was compromised through unawareness of risk, but today we know that awareness alone is not sufficient to avoid risk. Furthermore, as already stated *apropos* the concept of health, risk factors and protection mechanisms change over time, and their relevance and effectiveness also changes in line with the individual's development. *Some experiences perceived as negative or positive in one moment, can become functional or dysfunctional at a later time.* As an exemple, in the biomedical field, the resistance to an infection is the sign of previous contact with an infectious agent infected agent (bacterium, virus), thus, a negative event (*infection*) can become advantageous for the individual (*immunisation*). Advancements of knowledge in the biomedical field has facilitated the early identification of signals of illnesses and the development of measures to prevent or cure. The human organism has developed a series of automatic defence stragegies, such as the *cough mechanism* which allows the elimination of irritating agents in the respiratory airways, the *immune system response* which fights exogenous agents such as microbes, the *neuroendocrinal response system* which reacts to situations of imminent danger. Many instruments have also been perfected in medicine to limit negative effects and potentiate the organism's response to pathogenic agents (e.g. vaccines, etc.). In the psychosocial field, risk prevention/health promotion is much more complicated due to the greater number and

complexity of variables (biological, environmental, psychological) involved in human behaviour. Similarly to the biomedical field, psychological studies have demonstrated that an individual's capacity to resist acute stressful events is derived more from having successfully overcoming such events previously (immunisation) than from having avoided them (escape mechanism). There are many **protection factors** generally classified as: *internal/individual* (biological, temperament, capacity of adaptation, *life skills*, etc.), and *environmental/context* (family, school, society). Individual behaviour is often the product of interaction between more than one factor.

Through teacher-guided interaction with the pupils, **risk behaviours** can be identified and analysed, that can refer to events, threats, dangers that increase the probability of negative consequences for the individual's health and social adaptation, and **preventative behaviours**; those defence strategies and resources that help the individual to cope with challenges and risks of daily life, and that will protect him/her from maladjustment or illness.

After this preliminary activity with the schoolchildren, some ***risk behaviours*** can be identified: *infection, accidental risk, dysregulated/unbalanced nutrition, physical exercise, sleep*; *addicition (computer, social groups, gambling, smoking, alcohol, drugs); aggressive behaviour towards people and things (bullying, intolerance for diversity, vandalism, theft).* These risk behaviours will be analysed in more detail in five specific "mini-modules". We must remember that these behaviours—apparently different in appearance and consequences—often have a common origin (e.g. deficit of *life skills*, deprived or difficult social environment, sense of challenge, escape from reality,etc.).
Each of these mini-modules aims to transfer to the children specific information regarding risk behaviour, and encourage them to reflect on advantages and disadvantages in these behaviours, as well as proposing alternative strategies to achieve growth and well-being through non-risk behaviours, good practice and correct lifestyles.

The pupils will be asked to identify their own ***protective factors/behaviours, as well the defence mechanisms at their***

disposal, that consent them to face dangers to the best of their possibility and to achieve greater well-being. These factors are personal socioaffective and cognitive skills, and good practice as an individual and towards the environmental.

A) *Cognitive, relational and emotive abilities/skills life skills* that are necessary for each of us to positively relate to ourselves and to others and to face with greater confidence the problems and pressure of daily life. *Life skills* include the ability to to take decisions, to resolve problems, self-criticism, creativity, personal awareness, the capacity to observe and understand one's own weaknesses and strengths, empathy, emotional and stress management. A deficit in any of these skills can represent a factor of risk, while the presence often represents a protective element when faced with problematic situations or behaviour.

B) *Good practice* that helps us achieve and maintain health can be identified and are: Taking care of oneself and protecting oneself (hygiene, vaccines, medicine, use of crash helmet and safety belt), a varied and balanced diet, keeping one's body fit, resting, being curious and interested, the desire to learn, understand and take on new challenges, communication with others, a safe and trusted social network to share positive and negative moments, play, read, listen to music, dance, respect for oneself and others and social rules and norms, looking after good manners, beauty, education, etc.

   Good environmental practices can start from infancy and involve the rejection of any indifferent behaviour and the adoption of an active and responsible role which can help modify and improve the environment at home, in the school, park, neighbourhood and city (e.g. selective waste disposal,

not throwing litter on the ground, not making too much noise, using the bicycle rather than the motorbike, saving energy, using seasonal produce, etc.). Even if these actions have no major incidence on main environmental problems, such behaviour is educational and initiates the young citizen to a greater respect for the environment.

Poster *"The tree of well-being"*

Module 11 is going yo be delivered also through the use of a teaching materials called *The tree of well-being,* which consists in a large metal poster on which a series of obstacles (risks) and resources (protective/ defence mechanisms, good practice) can be represented. Starting with the children's suggestions from the mini modules mentioned before, examples of five types of risk (accident, dietary unbalance, insufficient physical exercise or rest, addiction, aggression) will be first exemplified, and at the meantime, protective strategies and bio-psychosocial defence mechanisms that can counteract these everyday risks and dangers will be identified. This project should create greater awareness of risk in the children, foster a desire for greater well-being and sharing of good practice (positive lifestyles), and finally to "make the flowers bloom on the branches"so as to achieve and maintain well-being and good health.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Mini-module 11.1
ACCIDENTAL RISKS AND HOW TO PREVENT THEM

EXPECTED LEARNING OUTCOMES

In normal conditions of life people move between different environments such as the house (domestic environment), the street, environments associated with study and work and leisure time. All of these environments are characterised to different degrees by the presence of positive qualities and "accidental risk factors" that can represent a danger for health and sometimes for life. These factors can be minimised structurally (safety of domestic appliances, safety in the workplace, etc.) but not eliminated because, to give some examples, cars and bicycles have to move along roads, electrical appliances have to be connected to the electrical system, windows have to open onto heights. To avoid accidental risks it is important that the individual be aware that these risks exist in everyday places and of the best measures to be adopted to avoid these.

The need to create "awareness of accidental risk" and of the ways in which these can be prevented are especially important in infancy and adolescence. Indeed, at these ages accidental risk represents one of the main causes of invalidity and death.

On completion of this Module, the children will be aware that:

- in modern society, we use many structures and sophisticated equipment that have been designed to improve the quality of life of citizens;
- these structures and equipment can also represent a risk for the well-being and life of the people that use them;
- the human factor must also be considered: sometimes danger derives from inappropriate behaviour of those living in these environments;

- accidents occur mostly when they are unexpected, and happen without any warning. They can be very serious because, unlike most illnesses, accidents can abruptly cause very serious and sudden consequences for someone in good health;
- the only action to take against accidental risks is *prevention*. And to prevent an accident we have to be aware of the risk factors present in every environment, and *the preventative measures that have to be taken to avoid these*.

When delivering this module, it is important to avoid presenting the surrounding environment as a world full of "negative factors" involving risk and danger. The message to be transmitted is that life is wonderful, and that the risks and danger do exist but can be avoided with awareness and prudence.

SUBJECT MATTER

The teaching objectives of this section of the Module~~s~~ are indicated below (in **bold**, the concepts or notions to be transmitted, in *italics*, experiences to be used in teaching).

The life of an individual is made up of a continual passage between different environments which are usually represented by the house in which we live, the streets that we use to move around, study or work environments where we carry out our daytime activities, and then places that are suited to leisure time where we go to socialise and have fun.

- *Ask the pupils to write a list of places that they have visited or have spent time the day before.*
- *Read together some of the lists written by the pupils and comment to let them realize that these places can be divided into four groups: domestic environments, external environments (streets, parks, etc.) study (or work) environments and leisure time environments.*

– *Ask the children to draw four posters symbolically representing "The Places of Life", (the home, the street, the workplace or study place, the leisure time place).*

The various environments where we live and spend time are generally structured to make life comfortable and pleasurable.

– *Ask the pupils to write on some post-it the characteristics and equipment that can make these places comfortable and pleasurable (colours, illumination, ornaments, air conditioning, furnishing, equipment, etc.) and attach these to the four posters that they prepared previously.*

These environments inevitably contain accidental risk factors that can be dangerous for our well-being.

– *Ask the pupils to write on post-its risk factors to be aware of (burns, electrocution, trauma, poisoning, etc.) that can be associated with each of these "Places of Life". Attach these post-it to the corresponding poster.*
– *Ask the pupils to identify the most dangerous areas in the domestic environment: the kitchen for burns, gas leaks, poisoning (ingesting inappropriate substances), the bathroom for accidental falls, for electrocution (the hairdryer in contact with water), and for burns (water too hot).*
– *Ask the pupils to identify the possible risk factors present in the class (trauma from boisterous games, etc.)*

To defend ourselves from accidental risk there are many sensible preventive measures that we have to know.

– *Together with the pupils, prepare for each "Places of Life" a list of the risk factors that have been identified and the appropriate preventive measures to be adopted.*

- *For every risk factor noted in each of the "Places of Life" posters, identify appropriate preventive measures to be adopted (keep away from the stove, do not play with electrical appliances, avoid climbing on furniture, do not lean out windows or balconies, do not drink unknown liquids, do not play boisterous games, observe traffic regulations also for pedestrians, do not play any sports that can be dangerous without proper training, etc.)*
- *Together with the pupils, write summary posters (one for each environment), including the risk factors to be aware of and the preventive measures to be adopted.*

Mini-module 11.2
THE RISK OF INFECTION AND THE DEFENCES OF THE ORGANISM

EXPECTED LEARNING OUTCOMES

During the course of our lives we are in continual contact with a great number of microorganisms present on the surfaces of our bodies, inside the body cavities in communication with the external environment, and also in the air in the surrounding environment. This condition is perfectly compatible with the condition of good health and should not cause any worry. It is opportune, however, to be aware how to manage in the best way possible those critical situations in which *such coexistence can cause illness.* Infancy and adolescence are the optimal ages to acquire "awareness of the risk of infection", and the fundamental preventative actions to be adopted.

On completion of this Module, the children will be aware that:

- microorganisms are present in the in environment in much greater quantities than other living beings;
- there are many types of microorganisms, all too small to be seen with the naked eye;
- microorganisms are present everywhere, in the air that we breathe, in the food that we eat, on the surfaces of our bodies, in our mouth, nose and intestines, and on all surfaces and cavities of our bodies that are in contact with the external environment;
- most microorganisms are not harmful for humans, and can even be vital for our good health, or useful in the preparation of food and drinks. Other microorganisms can cause illness (infectious illnesses);
- the human organism has many automatic defence mechanisms, such as the *immune system response* which helps combat against exogenous agents such as microbes and viruses;

- advances in biomedical sciences have facilitated the early identification of symptoms of illness in our bodies and help prepare ourselves to prevent or cure these. Some instruments have been devised to strengthen the response of the organism towards pathogenic agents (*drugs, vaccinations*, etc.);
- most common infections get better without any treatment, or with bedrest, lots of liquids and a healthy lifestyle;
- if antibiotics are prescribed by the doctor then it is important to take these as indicated.

As stated in the Module on *accidental risk*, it is appropriate also that this module be delivered to generate curiosity in the pupils regarding the complexity of the environment that surrounds us, but without representing the environment in a negative perspective, full of risks and danger. The message to transmit is that the environment that surrounds us is complex and can represent danger, however, this can be easily avoided by being aware of it and by adopting a correct and prudent behaviour.

SUBJECT MATTER

The teaching support material used to be used to achieve the above aims is detailed below (in **bold**, know-how to be developed through an inductive approach; in *italics* the experiences to be used).

Microorganisms are everywhere and are more numerous than any other living beings. Only a small fraction of these are harmful to mankind.

- *Do You already know that there are living organisms that can be seen only with the microscope?* (Some pupils might remember the experiment they had done studying the cell, staining yeast cells and looking at them through the microscope). *Some living organisms are so small that they are called <u>microorganisms</u>. Some microorganisms you have probably heard of already.* (Some children may remember the words microbes or viruses). *We can also ask the following: have you ever heard anything about microbes or viruses? In what circumstances did you hear about these?*

(Some children may connect these words to episodes of illness, their own or someone else's). *Do microbes may cause illnesses? Who has had whooping cough?* This is caused by micro-organisms called bacteria. Bacteria are also microorganisms. *Have you ever had marks or red spots on your skin? What are these illnesses called?* (chickenpox, measles, mumps). *What are they caused by?* These illnesses (known as the infectious diseases of infancy) are caused by microorganisms that are even smaller than the smallest bacterium and are known as viruses. Introduce the concept of contagion, i.e. the transfer of viruses or bacteria from one person to another through coughing, sneezing, dirty hands. Two common diseases caused by viruses are the cold and the flu (*See teachingsupport material: Contagion and the use of medicines*).

- *When we are not ill, are we still surrounded by bacteria? Is the presence of bacteria always associated with illness? Do we have bacteria on our hands and bodies, or on the floor of our house, or on our desks even if we are not ill? What can we do to see them?* (see *Teaching support Material*: *Video unwashed hand*; *Experiment with fluorescent gel*; *Experiment with sliced bread*). These experiments will stimulate discussion on the widespread diffusion of microorganisms. In particular, the evidence of the presence of bacteria on our body surfaces even in cases of no illness will help the children understand that we live in an environment with elevated quantities of bacteria everywhere. They are present in the air we breathe and in the food we eat; bacteria are found in all our body cavities that communicate with the external environment, i.e. the mouth, intestines and also the respiratory passages and our bodies do not suffer from their presence. Extremely high quantities of bacteria are also present in the intestines and they also contribute to protect us by entering into competition with other harmful bacteria and by synthesising vitamins for our bodies. The symbiotic equilibria of microorganisms that live within the

human body without damaging it is called *microbioma*. Their numbers are such that they constitute more than half the weight of our faeces. *So, we can see that some bacteria cause illness, others are harmless, and others can even be useful for our organism.*

We may use the abilities of microorganisms to our own advantage.

- *Have you ever seen how bread dough grows in size when it is left a little before cooking? Do you know how alcohol in wine and beer is made?* There are some microorganisms, *yeasts*, that are useful to humans because they are responsible for the process of *fermentation*: they feed on complex sugars and break them down into more simple compounds such as carbon dioxide and alcohol. E.g., yeasts from the family of *Saccharomyces cerevisiae* (commonly known as brewer's yeast) is used to leaven bread (the carbon dioxide that is produced by breaking down starch in the flour makes the dough swell) and to produce alcoholic drinks (transform sugar in grape juice or barley malt into alcohol present in wine or beer).

The organism has natural defence mechanisms to protect itself from the attack by pathogenic microorganisms.

- *The organism has many <u>natural barriers</u> as an obstacle against bad or pathogenic microbes entering our bodies, and this is one of the ways in which we protect ourselves from infection.* E.g., our skin forms a barrier that stops microbes from entering our bodies, our nose produces a sticky substance (mucus) which traps microbes that we inhale, our tears contain substances that can kill some bacteria, and our stomach secretes acid which can kill many of the microbes that we eat. In general, when we live a healthy life (eating a balanced diet, drinking an adequate amount of water, taking exercise and resting when necessary) these natural barriers help to keep us healthy. In some cases, however, microbes

can cross these barriers and make it to enter into our bodies, and so we get an infectious disease.

- *Tell the pupils that when they are ill, they do not always have to take medicine, because in many cases the organism is able to combat bad microbes by itself.* Explain that our organism has an *immune system* that can fight harmful microbes. When we are ill, if we sleep, eat and drink well, then we can help our immune system protect ourselves, and fight harmful microbes.

Science has developed systems of protection and defence

- *For some diseases our immune system needs to be helped to fight some micro-organisms*. *This may be realized with two different approaches:* ***vaccinations****, a preventive therapy which makes the body able to better defend itself from the onslaught of viruses or bacteria* (*See background for teachers*), *or by the administration of* ***medicines*** that allow to treat the diseases when they have already manifested.
- *Explain to the children that some types of medicines are used not to treat the illness (its cause) but the symptoms,* (e.g. cough syrup for a cough, nasal sprays for a blocked nose, a painkiller for a headache or a medicine to reduce fever, etc.).
- *Other medicines are used to treat not the symptoms but the causes of an illness . Antibiotics are the most common of this type of medicine that are prescribed for curing bacterial, but not viral infections. Explain that there are different types of antibiotics which attack different bacteria,* (therefore we should not use antibiotics prescribed to someone else, because it might not work for our illness: we must only take the antibiotics that have been prescribed to us by the doctor).
- *Before antibiotics were discovered, harmful bacteria killed many people. Today many bacterial infections are easily cured using antibiotics, but now bacteria are fighting back! The growing and sometimes improper use of antibiotics has caused some bacteria to become resistant to them*- The consequence of this is that some bacterial infections can once

again be mortal. We can help stop this process in various ways:

- *using antibiotics only when prescribed by the doctor for that specific illness;*
- *taking antibiotics for the entire duration of the prescription;*
- *not using antibiotics without a prescription, perhaps for a simple cough or a cold.*

- *Antibiotics prescribed by the doctor are used to fight harmful bacteria*. *Some antibiotics kill bacteria, and others just block their proliferation. Antibiotics can cure some illnesses caused by bacteria such as bacterial pneumonia, bacterial meningitis*, (but they have no effect on viruses and therefore cannot cure diseases such as influenza or the common cold which are caused by viruses).
- *Explain that if the doctor prescribes antibiotics, then they have to be taken for the entire stated duration;* we cannot interrupt treatment earlier, even if the fever has gone. (If we stop before, we might not have killed all the dangerous bacteria and those that survive can make us ill again, and by doing this we can also have selected some bacteria resistant to that antibiotic). (*See teaching support material: Contagion and the use of medicines).*
- *There are also medicines that are used to combat viruses and fungi: but it is important to know that even these have to be prescribed by a doctor.* Many over-the-counter products are used only to alleviate the symptoms of infections, e.g. painkillers or other medicines to reduce fever.

Background Information for the teacher

Microorganisms are living organisms that are generally too small to be seen with the naked eye. They are present everywhere in the environment. Some microorganisms can be useful for mankind, others can be harmful. They have different shapes and dimensions and belong to different categories: viruses, bacteria, protozoa, fungi.

Viruses are the smallest microorganisms and are generally harmful, e.g. influenza virus, measles and chickenpox viruses. They are not

"autonomous": they can survive and duplicate only if they enter a host cell. Once inside the host cell, they multiply and destroy this cell and then invade another one.

Bacteria (or microbes) are unicellular organisms that can double their number very rapidly, even every 20 minutes. They have various forms, and their name often reflects their form: *coccus* usually defines a spherical form, (e.g. staphylococcus, enterococcus, streptococcus), *bacilli* are usually stick-shaped, (e.g. *Bacillus anthacis*), *helical* are usually spiral-shaped, (e.g. *Heliobacter pylori*). Some of these bacteria or pathogenic germs are harmful for humans because they can cause illness. Other bacteria are not harmful and sometimes even important for our health. The enormous quantity of bacteria that populates our intestines belong to this last category (defined overall as the *intestinal microbiota*). These form more than half of our faeces and contribute to the immune system of the intestines by entering into competition with pathogenic bacteria, synthesize vitamin K, folic acid and other vitamins of the B group) and ferment some otherwise indigestible complex carbohydrates. Other bacteria are very useful by contributing to our food (e.g. lactobacteria that transform milk into cheese or yoghurt).

Sometimes protozoa can also invade our organism and cause illnesses such as malaria, toxoplasmosis, and dysentery.

Fungi are multicellular organisms belonging to the family of mycetes that can be both useful and harmful for the organism. They obtain nutrients by either decomposing dead organic material or through a parasitic relationship with a host. Fungi (e.g. *Candida*) can also provoke illnesses known as *mycoses,* or can help combat other illnesses like the fungus *Penicillium* which is used to produce the antibiotic *penicillin*. Some fungi are not microorganisms and indeed large, and can be eaten; e.g. common wood mushrooms or cep mushrooms.

Yeasts also belong to the family of mycetes and are useful to humans because they are responsible for the well-known process of fermentation: they feed on simple or complex sugars and degrade these into other simple compounds such as carbon dioxide and alcohol. For example, yeasts from the family of *Saccharomyces cerevisiae* (commonly known as brewer's yeast) are used to leaven bread (the carbon dioxide produced by their breaking down starch in the flour, makes the dough swell) and in the production of alcoholic drinks (they transform sugar in grape juice or barley malt into alcohol present in wine or beer). Another important use for microorganisms is in the treatment of wastewater (sewage) in activated sludge purification plants.

Defence mechanisms: ***Epithelial barriers, Immune system, Vaccinations***

Our bodies are extremely efficient in protecting our health. They do this through two main lines of defence:

1. By impeding pathogenic germs from entering our bodies

All surfaces of our bodies, both external (the skin) and internal (mucosae) are covered by a tissue—epithelial tissue—which forms a continuous barrier and impedes microorganisms from entering our bodies. In addition, some mucosae have additional mechanisms of protection: e.g., the *epithelia of the respiratory tract are lined by a thin layer of mucus* which can trap exogenous particles and bacteria, preventing them from reaching the lungs. These epithelia are additionally equipped with a thin mobile layer (cilia) that moves mucus upwards to be eliminated by coughing. *Likewise, tears that continuously wet the epithelium covering the surface of our eyes have a double protective function:* they prevent the eye surface from drying and contain substances (e.g. lactoferrin and lysozyme) which can kill bacteria and fungi.

2. Through the immune system

Blood contains cells, white blood cells or leucocytes that are the main actors in the **immune system**. The immune system has the task of protecting us from all that it is not "ours": foreign cells that penetrate our organism like the microorganisms that we mentioned before, and other cells of our own that become "foreign". White blood cells have two main ways of intervene. A more basic and direct way (*innate immunity*) through *phagocytosis*: *phagocytes* are a type of white blood cells, or cells derived from them (neutrophil granulocytes and macrophages) that recognise, attack and destroy foreign cells by devouring and destroying them.

In some cases, the bacteria can kill phagocytes and, when this happens, we can see a spot or pimple full of pus: the yellow liquid is made up of dead phagocytes.

Beyond this "first line defence" represented by phagocytes, the immune system uses another more elaborate and complex defence mechanism (*acquired immunity*) which is mainly carried out by another family of white blood cells, the *lymphocytes* and cells derived from them. When these identify foreign molecules in the organism (known as *antigens*) and often found on the surface of the bacteria, they start to produce proteins known as *antibodies*, which bind to the antigen and to help the phagocytes' work, in some cases, the antibodies can even directly kill the target cell. Antibodies can also neutralise toxins produced by bacteria (e.g. tetanus toxin).

Antibodies circulate in the blood, but they can also cross the mucosae to provide additional protection to the mucosal barrier.

3. Through vaccinations

A third line of defence is represented by vaccinations. A lymphocyte is able to make antibodies against only one antigen. Once some "virgin" lymphocytes in the immune system have identified an antigen and produced antibodies against that antigen, they remain in circulation even when there is "no more danger" as the antigens in no longer in the body. The significance of their continued presence is clear: if a certain foreign antigen (bacteria, virus or bacterial toxin) has been able to enter our organism once, this can happen again and so it is best to be prepared by keeping the lymphocytes already trained to respond promptly to that antigen in circulation, so reducing the time to produce the appropriate antibody. In this way the body has an immune memory of the disease-causing antigens that have been attacked in the past by antibodies, and such memory prepares it in a very short space of time for a second attack by the same antigen.

The strategy on which **vaccinations** are based precisely exploits the immune system's memory When vaccinated, we introduce into the organism an antigen that has something to do with a certain disease, but has been rendered harmless (e.g. viruses or bacteria that have been killed or made unable to reproduce, or a toxin, such as tetanus toxin, rendered harmless by some type of treatment). The immune system - ignoring that the virus, bacteria or toxin has been rendered innocuous - reacts by activating its defence mechanisms as if it were a real microbiological attack. The consequence is that - thanks to the vaccination-provided immune memory - due to the vaccination, the organism becomes ready to respond immediately with the production of antibodies in the case of a true attack.

TEACHING SUPPORT MATERIALS

Video unwashed hand:
Video showing the large amount of bacteria that we collect every day on our hands from the external environment (kitchen sponge, coffee menu, public bathroom, supermarket trolley, dog saliva, cell phone) https://www.youtube.com/watch?v=5XG-87yGZK0

Experiment with sliced bread: where are the most microorganisms in my kitchen?
In this fun experiment, we discover where microorganisms hide in our kitchen. Remind the children that not all microorganisms are harmful, indeed most of them are completely innocuous for humans. Have fun being a microorganism detective!

Required materials

4 slices of bread
4 sealable plastic bags, like those used for sandwiches
1 magnifying glass
1 felt-tip pen for plastic surfaces
1 notebook
1 camera (optional)

Method

1. Dampen the pieces of bread by leaving them on a wet plate
2. Take one of these and put it in a plastic bag Seal the bag and write “CONTROL”.
3. Take one of the other 3 slices and rub it on the floor of the kitchen, trying not to break it. Put this in another bag, seal it and write “FLOOR”.
4. Repeat the procedure on another two kitchen surfaces (e.g. the sink, inside the refrigerator), place the pieces of bread in a bag, seal them and write the name of the surface.
5. Put the plastic bags in a cupboard and leave them for at least one week.
6. Each day make some notes and/or photographs of each of the slices. NEVER open the bags.

Explanation of results

The "control "slice of bread will be useful in the comparison with the other slices in the experiment. The control has not been in contact with any surfaces and should show only a few microorganisms (perhaps those present on the hands!).

The other slices should show some signs of microbial growth. This will demonstrate that different areas of the kitchen have different types and numbers of microorganisms.

Experiment with fluorescent gel: the hygiene of hands.

Start this activity by asking the children if they think it is important to have clean hands, and if yes why (*we always use our hands and doing this we pick up millions of microorganisms: some are harmless, but others can be harmful*).

Ask the children when they should wash their hands (*after going to the bathroom; before preparing food or touching food with our hands; after blowing our nose: if we have a cold and we do not want to infect other things, or even other people by touching; when we go home, especially if we have been on a train or tram because when we stand on a bus, we have to hold on to supports that have been touched by hundreds of other possibly dirty hands; after touching animals, etc.)*

Ask the children if it is sufficient just to rub their hands under the tap (no, you also need to use soap). Why? *(our skin is covered by a thin layer of oil that protects us, but this is the perfect habitat for bacteria.* Therefore, we need soap which dissolves the oil and takes away the bacteria). How can we check if what you have been told is true? *Let us do an experiment that shows us the best way to wash our hands.* Explain to the children that we will use a fluorescent gel to highlight the microbes that we have on our hands.

Required material for each class:

1 tube fluorescent gel (hair gel which becomes fluorescent under a Wood's lamp)

1 Wood's lamp or fluorescent light

1 bar of soap

kitchen paper roll

4 blindfolds
sheets of paper to record observations (1 per child)

Procedure

Divide the class into 4 groups of children. Line the groups up and classify them as follows:

Group A: Unwashed hand
Group B: Hand washed in cold water
Group C: Hand washed in tepid water
Group D. Hand washed in tepid water and soap

The first child in each row will be blindfolded and will distribute on the palm of his/her hand some fluorescent gel. The blindfold is used to ensure that the child will not wash his/her hands more carefully than usual.

Now ask the blindfolded children in groups B, C, and D to wash their hands according to the specification for the group and dry them on some kitchen paper and then take off the blindfolds.

Each of the four children (including the "unwashed hand" one) will now firmly hold/shake hand with the next child in their group (number 2 in the row). Child 2 will then firmly shake hand with Child 3, and so on until the last child in the row.

When finished, turn off the class lights (and close the window or shutters as necessary) and turn on the Wood's lamp. Examine the children's hand starting with Group A (unwashed hand).

Ask each child to write down in the questionnaire below their observations on the experiment.

Get all children to wash their hands.

Discuss the results with the children.

1. *What was the result the surprised you most? Explain why soap takes away the gel from our hands and at the same time the germs or microbes that are attached to it.* 2. *Underline the fact that not all microbes on our hands are potentially dangerous.* 3. *Stress that hands must be washed carefully, using soap and tepid water, because bacteria can also hide between the fingers and under the nails. It is important to know how and when to wash our hands.*

MY OBSERVATIONS ON THE EXPERIMENT

WASHING HANDS

Child	Group A *(unwashed hands)*	Group B *(cold water)*	Group C *(tepid water)*	Group D *(tepid water & soap)*
#1				
#2				
#3				
#4				
#5				
#6				
#7				
#8				

N.B. To summarise the observation to be written on the table regarding the hands of your schoolmates, use one of the following scale: *Very dirty, dirty, a little dirty, clean*

MY CONCLUSIONS

1. What is the best way to get rid of microbes on our hands?

   _____

   _____

2. What is the difference if we use soap or do not use soap?

   _____

   _____

   When should we wash our hands?

   _____

   _____

Contagion and the use of medicines[1]

Give each child a copy of the following two sheets (taken from the website www.e-bug.eu), containing some cartoons about Amy and Natasha at school. The children can read about various situations at risk for infection that the two girls are discussing.[2]

Discuss with the children the phrases written in *italics* in each of the cartoons and ask if they agree with the various points. Use this to initiate the general discussion indicated on the third sheet.

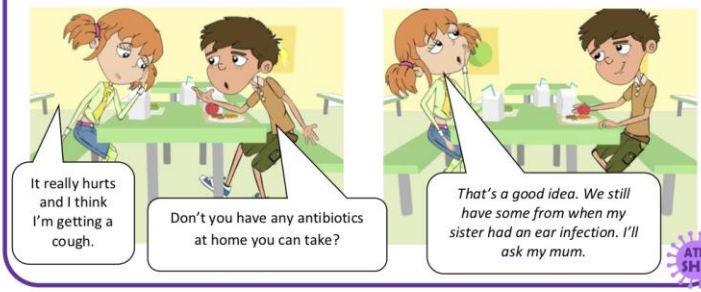
[2] e-Bug is an educational free resource prepared by a team collaborating with the UK Public Health Agency. The aim of this material is to render information on microorganisms, on the diffusion, and the prevention and treatment of infectious disease accessible and fun for children.

http://www.e-bug.eu/lang_eng/primary_pack/downloads/aam/Antibiotics%20Complete%20Pack.pdf

1. **Amy went to school not feeling very well. She had a headache and a runny nose. When she arrived in the classroom she took a seat beside Natasha. She soon realised that Natasha was also not well.**

2. **At lunch time, Amy and Natasha went to the toilet. Natasha was hungry and in a hurry to have her lunch.**

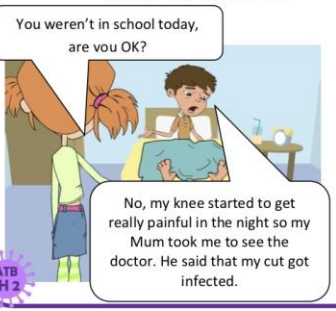
3. **During lunch Amy was talking to her friend Harry about her headache and runny nose.**



4. After they had eaten, the children went out to play. Harry fell over and cut his knee very deeply.

5. When Amy got home, her mother decided to take her to the doctor. He said that she had a bad cold.

6. Harry didn't come to school the next day so Amy called around to see him on her way home from school.



4.1 Treatment of Infection
Antibiotic Use and Medicine
Discussion Points

Natasha should cover her mouth whilst coughing. Infection can easily spread from person to person through coughing and sneezing. A sneeze travels at approximately 100mph and at high force meaning that the microbes carried in a sneeze can travel very far and infect other people.

You should always wash your hands after going to the toilet. Many bad microbes that make you ill are found in toilets. Good personal hygiene is essential to a healthy lifestyle and can greatly reduce the spread of infection. Trials show that proper hand washing reduces absenteeism in schools, not just from tummy bugs but from coughs and colds too.

Amy should NOT use her sister's antibiotics. There are many different types of antibiotics which treat different bacterial infections. Doctor's prescribe specific antibiotics for specific illnesses and at a dose suitable for the patient. Taking someone else's antibiotics may mean your infection does not get better.

Mrs Warren should have washed Harry's cut knee to clean any dirt or microbes which may have been present. Antiseptic cream applied to deeper cuts can also help prevent infection. There is generally no need to cover smaller cuts and grazes with a band aid, fresh air will help the scabbing process.

The doctor is right; antibiotics only work on bacterial infections. Coughs and colds are caused by viruses and in many cases the body's own natural defences will fight these infections. Other medicines from the chemists help with the symptoms of coughs and colds.

It is important for Harry to finish the course of antibiotics. Not finishing the course could result in the bacteria not being killed properly and becoming resistant to the antibiotic is the future.

Mini-module 11.3
TOO MUCH AND TOO LITTLE
The risk of disequilibrium in eating, in physical activity and in the sleep/wake cycle

EXPECTED LEARNING OUTCOMES

This module aims to create awareness in the pupils of the importance that a correct, balanced lifestyle in nutrition, physical exercise and sleeping bears on good health.

On completion of this module the pupils will be able to:

- elaborate the concept of "equilibrium" as applied to lifestyle;
- understand that living beings constantly need to take resources from the external environment for their vital functions and also for their relationships;
- understand the basic components of human nutrition and their relative functions;
- be aware of the many factors influencing our nutrition (sensorial perception, psychological, cultural, social, and religious);
- be aware of the risks caused by an unbalanced diet;
- understand the requirements for a balanced diet;
- be aware of the importance that a constant and balanced physical exercise has to the general health of the individual;
- understand the function of sleep and also the risks of any imbalance in the sleep/wake cycle

SUBJECT MATTER

(In **bold**, notions or concepts to be transmitted; in *italics*, experiences to be used in the inductive teaching activities)

The importance of "equilibrium" as applied in lifestyles

- *show the pupils and discuss with them a photograph of a tightrope walker suspended above a sheer drop (to not to fall, the tightrope walker has to proceed cautiously, without stopping nor running);*
- *As for the tightrope walker "too much" (running on the tightrope) or "too little" (stopping on the tightrope) may cause a risk, similarly for human beings "too much or too little", as applied to nutrition, physical exercises or the sleep/wake rhythms can also cause harm, as you will see later.*

As an introduction to this section of the mini-module on balanced nutrition, *the teacher should elicit discussion on some topics already discussed in Module 10, particularly*:

- To grow and carry out their vital functions, all living beings need to eat; this involves taking from the environment every day all nutrients needed to supply the molecules that the organism needs. These nutrients contain the energy necessary for life.
- Nutrients (food and drinks) are made of water and other substances (protein, fats, sugars, mineral salts, vitamins) necessary for the growth of the organism and for its vital functions.

Differently from animals, human beings do not only eat to simply nourish themselves. Food has taken on many significances and functions in human society, starting with breastfeeding which – although common in mammals – creates a fundamental link in human relationships.

- *Identify and propose some short passages from books regarding the following arguments, and discuss these with the pupils:*

food eaten together with the other members of the clan strengthens social relationships;
food is distributed according to social hierarchy;
offerings of food are given as a sign of friendship and respect (to the gods, to strangers);
food is eaten to celebrate: the end of a conflict, the harvest, a commemoration.

- *Ask the pupils what special foods are prepared at home for various festivities, and how these differ depending on what is being celebrated (how is it prepared, the quality and cost of the food, the presentation on the table...).* (Pupils from various countries will add to this activity and can help understand the significance that types of food have not just with culture but also with the environmental conditions).

Food involves all our senses

- *Ask the pupils what sense is most involved when eating (*in addition to taste, which is obviously fundamental for the choice of food and for it to be tasty*);*
- *Ask the pupils if they believe that other senses* (sight, smell, hearing, touch) *can also have some importance in eating* (well-presented foods can "be eaten with the eyes"; the sight of well-prepared food "whets the appetite"; the sight of disgusting things "takes away the appetite"; "a good smell" from a plate of food makes you want to eat it, whereas a bad smell puts you off: when sitting at the table we should not speak about disgusting things to not "put other people off their food"; a steak can be delicious when it is "tender"; chips have to be "crunchy").
- *Ask the pupils if they have any pets at home; if so, ask them to observe their pets when eating and drinking, and what they do*

when observing us eating. Ask them to relate to the class their observations.

- *Identify with the pupils some sensorial experiences other than taste that are involved in eating* (ice-cream is delicious because it is "cold"; a cappuccino must be "nice and hot": a delicious soup should be hot and "creamy").
- *For some fun, watch the video* Obese Animals: [https://www.youtube.com/watch?v=AJOBESvAti8]. *Discuss and comment why only domestic pets and not wild animals can sometimes become obese (lack of physical activity, boredom, shop-bought food different from food found in nature).*

Nutrition is strongly influenced by the psychological and physical characteristics of the individual

- *Ask the pupils to make a list of things that they like eating as snacks; get them to state when they eat these foods, and when they eat most.* Start to make a poster with all the pupils' answers and discuss this together (discuss possible shared parallels between certain situations and desires for similar foods);
- *Ask the pupils if they think psychological factors may have a positive influence on eating* (a meal shared with friends is always pleasurable; one is always happy to eat when there is a party; "grandma's home-baked cake" is always the best; infants enjoy breastfeeding because they feel protected by their mother's arms, etc).
- *Ask the pupils to identify some psychological conditions that can negatively influence eating, reduce appetite or oppositely, make someone eat more or even eat a lot of "junk food"* (anxiety, bad results at school, being told off by parents, arguments with schoolmates or friends, low self-esteem, etc.).

- *Ask the pupils if they think that illness can be the cause of loss of appetite, or even make food seem unappetising. Ask the pupils if they can remember any recommendations from the doctor or family members about eating when they were ill.*

Eating is influenced also by cultural, social, and religious factors

- *Show the pupils the photograph of the Venus of Willendorf (see Module 10) and ask them why such a fat woman was probably considered very beautiful by our ancestors* (in ancient times, it was difficult to find food and therefore a fat person symbolised well-being and prosperity);
- *Ask the pupils what image today would correspond to the beauty of that Venus: distribute some pictures from magazines (cinema stars, singers, advertisements for beauty centres, etc.) and ask them to identify what they consider "beautiful" men or women. Share and discuss their choices. Show the pupils some photographs from a fashion show and discuss with them why—especially for women—thinness is today considered an important attribute of beauty* (the influence of fashion and mass communication that publicises extremely thin models)*;*
- *Watch the first part of the video "*Bio, costoso, quindi più buono",
- [https://www.youtube.com/watch?v=zKHm_kQRevQ&t=182s]; *and comment it; Ask the pupils if they remember some television adverts about food and why this advert was able to capture the attention of the viewer or render the product more enticing. Compare their answers and discuss them to identify factors that can influence eating behaviours* (advertisements for preserved food; promotion of drinks and snack foods, etc);

- *Ask the pupils how different religions can influence the choice of food (*Muslims should not eat pork; Hindus should not eat beef; Jews should follow strict dietary rules; not long ago, Catholics did not eat meat on Fridays; some hermits and monks practice fasting): *what are the pupils' explanations for this?*

Too much and too little in nutrition (obesity and pathological thinness)

- *Show some images of excessively fat or excessively thin people. Give the pupils the following task: "Remembering the journey of food through our bodies and its composition; draw and try to explain what happens to the body when we become fat". And then, "What happens when we become thin?".* Compare their drawings and their explanations;
- *Show the pupils a half chicken and the distribution of subcutaneous adipose tissue, and fatty deposits around the internal organs (heart, stomach). Comment on their observations and compare these with the human body, also noting the difference between the male and female bodies;*
- *Watch the video:* Food and Sport. Exploring the human body. [https://www.youtube.com/watch?v=8VhOcngRlys]

- *How to recognise useful and dangerous functions of sugars and fats (fatty deposits in arteries and in the liver);*
- *Look at the images of lipid and sugar molecules constructed from the kits of atoms used in Module 9. Ask the pupils to bring some blood analysis that they or some family members have done to identify what fats are analysed;*
- *Identify with the pupils the possible consequences of excessive eating or lack of sufficient nutrition* (metabolic illnesses such as obesity, diabetes, cardiovascular illnesses, e.g., hypertension, heart attack, stroke, etc.; on the opposite

side, pathological thinness and consequent risk of illness such as anaemia, osteoporosis, stunted growth, immune deficiencies*);*

- *Share some images showing the consequences of a balanced diet (protein, fat and sugar present in appropriate quantities), and an unbalanced diet, (for excess or defect of one component). Introduce the concept of "too much or too little" not only for the quantity of food that we eat but also for its basic components (see Module 10).*

Awareness of different eating habits in the various countries

- *Show some data of the Food and Agricultural Organisation of the United Nations (FAO) on imbalances in "ecological footprints": (quantity of land and environmental resources used for food production) between countries:* http://www.fao.org/news/story/it/item/196458/icode/ . *Discuss this with the pupils.*

Good practice for a balanced diet.

- *Encourage the pupils to identify good practices for a balanced diet, writing their suggestions on the poster* (avoid any junk food or snacks or food eaten not for necessity but more for anxiety or boredom; avoid any alimentary excesses or deficiencies, "too much", and "too little" in the quantity and quality of the food and its components; try avoid being influenced by trends; try avoid being influenced by advertisements, give preference to fresh rather than conserved foodstuffs; do not depend on any particular food; respect all signals from the stomach, e.g. "empty/hungry" and "full/no longer hungry"; follow a varied diet; eat slowly and chew well; avoid watching television or using mobile phone when at the table; do not follow any "do-it-yourself diets"). (*see Note 1*)

Physical activity and its beneficial effects.

- *Discuss together with the class some photographs of pupils and adults engaged in various physical activities; identify and write down on a poster the various beneficial aspects that these activities have on the human body* (*physical effects*: increased resistance to fatigue, reinforcing the bones and muscles; improving the capacity to coordinate various parts of the body; improving the cardio-circulatory function; *effects at the mental level*: Improvement of the sleep/wake cycle, stimulate the capacity for socialisation; generation of positive emotions and sensation of well-being; development of skills such as attention and perception, etc.).

"Too much" and "too little" applied to physical exercise (hyperactivity and laziness).

- *Comment on images depicting various types of laziness or oppositely, excessive or dangerous physical exercise (extreme sports); identify together with the pupils the possible negative effects of excessive laziness, or excessive physical exercise. (Excessive laziness:* weakening of the muscular and skeletal apparatuses; slowing of mental functions; listlessness: lack of application and spirit of initiative; tendency to gain weight. *Excessive physical exercise:* tiredness, excessive loss of weight; possible problems to muscular or skeletal apparatuses or to the cardiovascular system; risks associated with extreme sports).

Good practice for balanced physical exercise

- *Encourage the pupils to identify some good practices for balanced physical exercise, writing their suggestions on a poster* (respect rules of gradual training when starting a strenuous physical activity, respect signs from the body such as tiredness, cramp, pain to joints, etc., that the body can

send to signal excessive effort, be aware of one's own limits and accept them with serenity).

This diagram shows some activities in line with the capabilities of growing pupils to be carried out over the period of one week.

The function of sleep

- *Show the pupils some images of human beings and animals sleeping and discuss the function of sleep (humans and animals need alternate periods of activity and rest; all vital functions – such as mental activity, the circulation of blood, respiration – slow down during sleep to allow these functions to recover);*
- *Show the pupils some images of an electroencephalogram taken during sleep and waking and discuss this (see teaching support materials).*

"Too much" and "too little" applied to the sleep/wake cycle (hypersomnia and insomnia)

- *Give the pupils a questionnaire regarding their experiences with sleep and comment as a group on the results;*
- *In a group, identify some negative effects of imbalances in the sleep/wake cycle (tiredness, irritability, excessive distraction, difficulty in undertaking normal activities of work/study);*
- *With the pupils, comment on the data in the following table showing recommended hours of sleep by age: note that the needed hours of sleep decrease with increasing age.*

Good practice for a balanced sleep/wake cycle

- *Encourage the pupils to identify some good practices for a balanced sleep/wake cycle, writing on a poster the results* (avoid any overstimulating activity such as video games or mobile phone just before going to bed; prepare for sleep by doing some calming activities such as reading, personal hygiene, etc; avoid excessive eating in the evening, respect the sleep of others and avoid making noise at night; learn to adopt relaxation techniques for muscles or psychological calming exercises to encourage sleep).

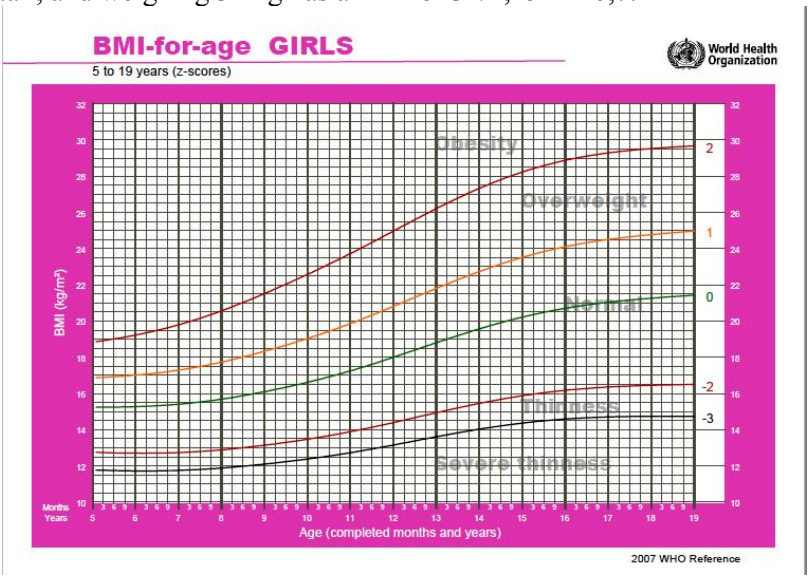
Correct number of hours of sleep

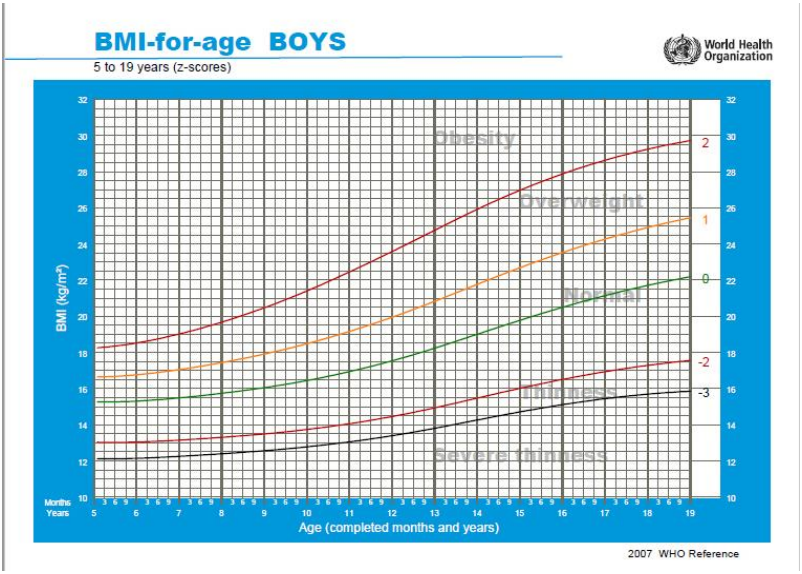
The American *National Sleep Foundation* (NSF) asked a multidisciplinary panel (including experts in sleep, anatomists and physiologists as well as paediatricians, neurologists, gerontologists, and gynaecologists) to formulate recommendations for various age groups. The following is a summary of the recommendations for younger age groups;

- Newborn (0 - 3 months): 14 - 17 hours per day
- Infants (4 - 11 months): 12 - 15 hours
- Toddlers (1 - 2 years): 11 - 14 hours
- Preschoolers (3 - 5): 10 - 13 hours
- School age pupils (6 - 13): 9 - 11 hours
- Teenagers (14 - 17): 8 - 10 hours

Note 1

The World Health Organisation has elaborated tables showing the relationship between the *body mass index* (BMI) against *age* and *gender*. The BMI is an index of the relationship between body weight and height and is calculated by dividing weight in kilos by the height in metres squared (kg/m^2). These tables can be used to evaluate "dietary health", e.g., if a person is underweight, normal weight, overweight, or obese. As an example, a schoolgirl 1.45 m tall, and weighing 32 kg has a BMI of $32/1{,}45^2 = 16{,}7$.




BMI-for-age BOYS
5 to 19 years (z-scores)
World Health Organization
Obesity
Overweight
Normal
Thinness
Severe thinness
2
1
0
-2
-3
BMI (kg/m²)
Months
Years
Age (completed months and years)
2007 WHO Reference

TEACHING SUPPORT MATERIALS

1. photograph of a tightrope walker walking on a metal rope suspended above a sheer drop.
2. photographs of excessively overweight or excessively thin people.
3. photographs of pupils or adults engaged in different types of physical activity.
4. photographs of different types of laziness, or excessive or dangerous physical activity (extreme sports).
5. photographs of humans and animals sleeping.
6. electroencephalographic charts recorded during sleep.
7. questionnaire for sleep experiences of the pupils.

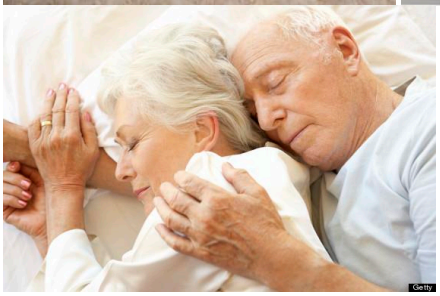
1. Photograph of a tightrope walker walking on a metal rope suspended above a sheer drop

2. Excessively fat or excessively thin people.

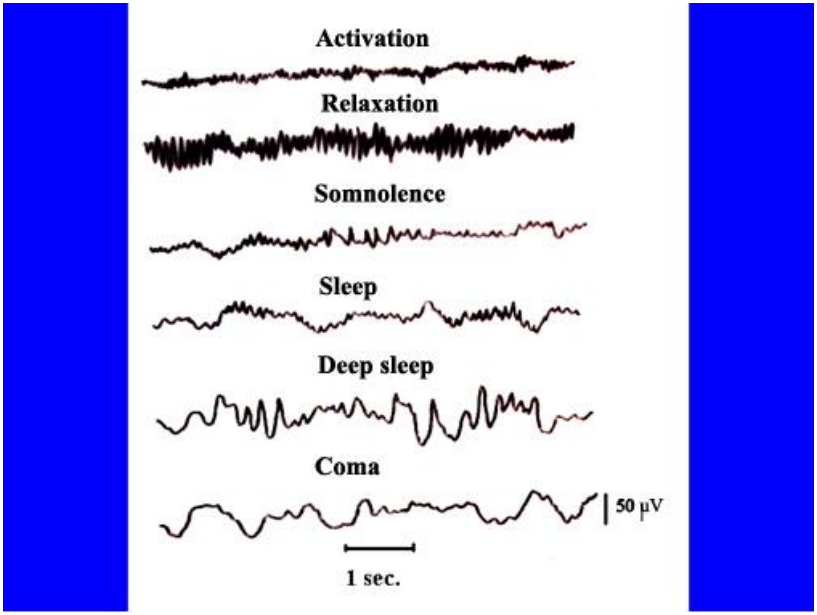
3. Kids or adults engaged in different types of physical activity.

4. Photographs of laziness and excessive physical activity

5. Photographs of humans and animals sleeping.



6. Electroencephalographic charts recorded during sleep and waking



7. QUESTIONNAIRE ON SLEEP

What time did you go to bed yesterday?

Did you play any videogames immediately before going to bed?

Did you read something before going to sleep or in bed yesterday?

Did you eat more than normal yesterday for supper?

Did you watch a film that frightened you yesterday evening?

Was there a lot of noise in the street or at home yesterday when you went to bed?

Did you sleep well yesterday, or did you wake up during the night?

What time did you wake up this morning?

Did you feel rested or still tired?

Mini-module 11.4
FROM ANGER TO VIOLENCE

EXPECTED LEARNING OUTCOMES

Aggressive behaviour constitutes a risk factor, both for the subject and for the recipient of this behaviour. It is appropriate to analyse together with the pupils this type of behaviour so that they may acquire awareness and a capacity to recognise it in themselves and in others; the overall aim is to let them develop strategies of self-control and biopsychosocial defence.

At the end of this section, the pupils will be able to:

- recognise characteristics and manifestations of aggressive/violent behaviour in humans and animals;
- be aware of the motivations and causes that can determine such behaviour;
- recognise the phenomenon of bullying and be aware of the damage this can cause;
- recognize good practice as applied to preventing or combating bullying.

SUBJECT MATTER

The teaching objectives to achieve the above aims is detailed below (in **bold**, notions or concepts to be developed through an inductive approach; in *italics*, the experiences or activities to be used).

Recalling knowledge regarding emotions. Emotions are mental states induced by external or internal stimuli and are present in humans and animals.

- *Recall briefly knowledge acquired in previous years (Modules 7) regarding emotions: examples of emotions such as fear, joy, surprise, sadness, disgust, etc; the universal nature of emotions which belong to all animals and that in human beings, are present in all cultures and countries; bodily, behavioural, and mental manifestations of emotions;*

importance of emotions in regulating social relationships in human beings.

ANGER

Anger is an altered psychological state, generally provoked by stimuli that remove inhibitory factors that normally moderate the choices of the subject. It is manifested as reactions to unpleasant external stimuli (e.g. physical or verbal aggression) or internal stimuli (fear, shame, envy, jealousy, etc.).

- *ask the children to tell of any episodes of anger that they have witnessed and try to explain the cause/s for this manifestation.*

Manifestations of anger can be mental, corporeal, or behavioural

- *together with the children, prepare a "POSTER ON ANGER", and identify mental manifestations (dissatisfaction, fear, desire for revenge, frustration, envy, hate, contempt), bodily manifestations (frowning, trembling, red in the face, alteration of voice) or behavioural (threatening attitude, violence, shouting) that are due to anger;*
- *together with the children, comment on pictures of expressions of anger in humans and animals (see teaching support materials).*

Sometime anger is not expressed externally

- *ask the children if they think anger can also remain hidden (most detective stories are based on episodes of hidden anger).*

Animals too can experience and manifest anger in certain circumstances

- *ask the children to describe any episodes of anger in animals that they have witnessed;*
- *list with the children the most common expressions of anger in household pets.*

AGGRESSION

Aggression is a behaviour that can be expressed in various ways and aimed at threatening, intimidating, contrasting, damaging or humiliating others.

- *comment on some images of human and animal aggression. Prepare with the children a poster on aggression; identify different "aggressive actions"* (facial expressions, threatening or offensive gestures, threatening or offensive verbal expressions, aggressive writings on walls, aggressive use of social media). *See Teaching Support Materials: Topics for discussion.*

An aggressive psychological temperament is characterised by scarce awareness of the consequences of one's own actions, and impulsive and uncontrolled actions.

- *ask the children to tell of some incidents of aggression that they have witnessed either directly or indirectly;*
- *reconstruct some aggressive characters from books (see teaching support materials, Proposals for readings of texts on violence) and famous fables (e.g. the Wolf from Red Riding Hood); the Wicked Stepmother in Cinderella; Snow White's Stepmother; the Witch in Hansel and Gretel, Captain Hook from Peter Pan, the Wicked Witch in Sleeping Beauty, etc.)*
- *comment together on some images of aggressive human behaviour (see Teaching Support Materials:* ***Images of violence in painting****) and try to define the characteristics of an aggressive temperament (ignorance, envy, contempt for others, lack of self-control).*

A protective/defence reaction can sometimes appear as a manifestation of aggression.

In some cases, an aggressive reaction can be the ideal reaction of defence when facing external danger or threats.

VIOLENCE

Violence is a behaviour which is often predetermined and aimed to create concrete damage to people or things.

- *observe and comment with the children some images of violence taken from newspapers, cinema or television programmes (see Teaching Support Materials).*
- *ask the children to tell of some episodes of violence they have witnessed.*

Violence can be expressed with physical actions, words and with writing.

- *It is aimed to create a position of psychological domination* (humiliation, derision, threats),
- *It may be expressed through the use of social media* (Facebook, Twitter, WhatsApp, etc.) *and with the use of instruments* (real or improvised weapons).
- *Together with the pupils prepare a poster on violence, identifying its fundamental forms* (physical violence, verbal violence, psychological violence, violence through social media, violence using weapons).
- *Victims of violence can be attacked on a physical or psychological level* (creating sensations of humiliation, fear, shame) *and also on an emotional-relational level* (creating conditions of isolation and rejection).
- *Observing the poster of violence prepared previously, try to identify together with the children the types of damages that different forms of violence can provoke in the victim* (physical damage leading to death or physical violence; fear, depression and isolation due to psychological violence, also practiced using social media*). Psychological violence can also be carried out through the manipulation of relations, a sort of brainwashing to determine the acquiescence of the victim. (See Teaching Support Materials: Topics for discussion.*
- *Can violence be practiced against oneself?* (suicide, self-punishing acts, self-harm, dangerous driving, extreme sports,

etc.)**,** *against others?* (homicide, physical and psychological abuse, threats, intimidation, fighting, cursing, derision, exclusion, etc)**,** *against animals?* (cruelty, ill-treatment or lack of care of domestic animals, cruelty to small animals in the environment, etc), *against things?* (theft, vandalism, etc), *against the environment?* (arson, improper disposal of waste, graffiti, , etc)**,** and *against society and its rules?* (arrogance against the weaker or different, non-observation of basic rules of civil cohabitation, racism, etc.).

– *Make some examples of violence and ask the children to identify each time the object of the violence (oneself, others, animals, things, environment, society).*

CAUSES OF AGGRESSIVE/VIOLENT BEHAVIOURS

- *Which may be the causes of aggressive/violent behaviour in animals?* (fear, hunger, feeling of danger for oneself or one's offspring, pain, defence of food, defence of territory, aggressive temperament, etc).
- *Can these same causes trigger aggressive behaviour also in humans? Identify with the children possible causes of aggressive behaviour that are seen both in humans and animals. Remind the children that some breeds of dogs, such as Rottweiler, Pitbull, have been selected for their aggressive behaviour.*
- *Can aggressive behaviour be triggered in humans for causes not indicated above, and more related to socio-cultural issues?* (frustration for lack of success, defeat, loss of goods, shame, etc*.) or environmental issues?* (conflictual family relationships, war, etc.).
- *With the children, identify possible causes of aggressive/violent behaviour in humans.*

BULLYING

Bullying is an aggressive and often violent behaviour especially widespread in younger generations. It is generally manifested inside social groups with the aim of dominating and humiliating others considered as being weaker or "different".

- *Ask the children the meaning of the term "bullying" and note down any significant answers; trying to reach a definition of this term (*violent–aggressive behaviour exercised towards an individual retained as being weak or "different"*).*
- *Identify together typical manifestations of bullying (*physical violence, psychological violence, threats, insults, abuse of power, derision, humiliation, isolation*);*
- *Identify damages provoked by bullying on the victim* (anger, depression, desperation, isolation);
- *Ask the children to tell about any episodes of bullying that they have witnessed.*

A bully is a "coward weakling" who wants to appear "strong and courageous".

- *Ask the children to define the term bully by choosing from the following group of adjectives:* (strong, weak, intelligent, stupid, courageous, coward, pleasant, unpleasant, good, bad, admirable, pitiful, deplorable). *Discuss these answers to reach an appropriate list of adjectives from an ethical and civil perspective* (bully: a "weak, coward" figure, who wants to appear "strong and courageous").

GOOD PRACTICE AGAINST VIOLENCE AND BULLYING

Can you think of "good practices" that can help prevent and counter aggressive/violent behaviour and bullying? (respect for oneself and others, improving cultural awareness and combating ignorance, cultivating sincere friendships, overcoming irrational impulses, capacity of reflection and foreseeing consequences of one's own actions, recognising the needs of others, being careful of how we communicate with others, trust in authority).

Together with the children, identify some "good practices" against bullying.

In a group, prepare a poster "Fighting Bullies in School", with the following categories: 1, definition of bullying; 2. emotional and behavioural characters of a bully; 3. good practices against bullying.

TEACHING SUPPORT MATERIALS

Topics for discussion (from the book: *La prevenzione in adolescenza*, edited by S. Bonino and E. Cattelino, 2008. Trento, Erickson)

Prepare a series of small cards and write on them the following of cue phrases; distribute these and ask the children to answer if they agree or do not agree with what is written on the card and comment their answer. The comments will be grouped, read and discussed.

1. During middle school, many children become aggressive.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

2. It is normal that when a child becomes angry, s/he becomes aggressive.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

3. It is correct to use violence to achieve important objectives.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____

_____
_____
_____

4. Victims of aggressive behaviour are usually “looking for it”.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

5. Dirtying the toilets in school isn't vandalism.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

6. Isolating another child and talking badly about him/her is not being aggressive.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

7. Janitors are paid to clean, and therefore they should not complain when litter the class with bottles, pieces of paper and scribble on the walls.

□ Agree
□ Don't agree

Explain why you agree or don't agree

_____
_____
_____
_____
_____

8. Sometimes to become part of a group, we have to do things that are prohibited or illegal.

□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

9. Taking something from the supermarket without paying for it isn't stealing but being intelligent.

□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

10. Only when we are adults can we say no to a group that makes you do something prohibited or illegal.

□ Agree

□ Don't agree

Explain why you agree or don't agree

_____

_____

_____

_____

_____

11. To steal or carry out acts of vandalism shows others that we are grown-up.

□ Agree

□ Don't agree

Explain why you agree or don't agree

_____

_____

_____

_____

_____

12. If parents impose rules without explaining them, then it is all right to break them.

□ Agree

□ Don't agree

Explain why you agree or don't agree

_____

_____

_____

_____

_____

13. It is normal to disobey one's parents.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

14. We have to learn to lie to teachers to get on at school.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

15. It is dangerous to tell lies, because you end up betraying yourself.
□ Agree
□ Don't agree
Explain why you agree or don't agree

_____
_____
_____
_____
_____

16. When we are part of a group, we feel able to do everything that the group asks: even sacrificing our own principles.
□ Agree
□ Don't agree

Explain why you agree or don't agree

_____
_____
_____
_____
_____

Images of Violence
Distribute images of violence, for example: Caravaggio: *Judith and Holofernes*, Picasso: *Guernica;* Titian: *Sesto Tarquinio and Lucrezia*; Goya: *Shooting of the Insurgents*, *Photographs of female victims of domestic violence.*

Proposed readings of short texts on violence
Bible: *Cain and Abel*; Euripides: *Medea*; Iliad: *Wrath of Achille*; Shakespeare: *Macbeth, Othello*; Saviano: *Gomorra* (book, TV series).

Mini-module 11.5
ADDICTION
Feeling well and being free

BACKGROUND INFORMATION FOR THE TEACHERS

It is important to agree on the definition of *addiction*. The word is derived from Latin *addicere* meaning to render the insolvent debtor slave. Addiction is a relationship – pathological if stable – between a subject and an object (substance, situation, behaviour, person) which "*enslaves*" the subject because it induces functional and structural alterations in the system of gratification. This relationship is characterised by restrictions in the modality and means by which the subject procures pleasure and a marked difficulty in giving up, due to cognitive, motivational and control of inner drives implications.

Addiction can also be associated to affection, such as that of a child for his/her mother, which is part of the normal growing process towards autonomy, but sometimes gets blocked and transformed into an addictive pathological relationship. Distinguishing between different types of addiction: *substance addiction (drugs), behavioural (gambling), mixed.*

As usual, in planning the present teaching activity, the topics will be dealt with by selecting information that is relevant to the pupils' daily accessible experience, which will be fundamental in letting them understand the phenomenon. This material can help orient the teacher in presenting the issue and in stimulating verbal interaction with the children.

EXPECTED LEARNING OUTCOMES

The general objective of this Mini module is to make the pupils aware that their correct development leads to complete autonomy in thought, judgement, relationship with themselves and with others. This objective can be jeopardised by behaviour or substances that interfere with mental functions and development, rendering the individual *incapable of thinking and acting independently.* Awareness of the nature of risks, and the habit of reflecting on one's own emotions and behaviour are fundamental to generate *protective mechanisms*.

On completion of this Module, the children will be aware that:

- in our normal diets, there are food and drinks which are eaten not for nutrition – i.e. for the energetic value they contain and needed for our bodily functions - but for their *stimulating, gratifying or calming effects.* The most common are coffee, chocolate, tea, wine and other alcoholic beverages, chamomile;
- the quest for pleasure and well-being is a normal human tendency; all cultures have identified in the environment plants containing substances that produce *well-being, high spirits, energising, that excite and prepare for battle, that ease physical or psychological pain or anxiety, that help sleep or oppositely that combat sleep, hunger, or tiredness.*
- many of these plant-derived substances are still used in the preparation of medicines (the term *pharmacy*, where these were prepared, comes from the Greek *pharmakon*, a noun indicating a substance that may be a *remedy* or a *poison*);
- some of these substances once ingested or inhaled, pass into the blood and affect some *specific neural centers in the brain responsible for gratification*; by acting on these, they influence the mind with "gratifying" effects;
- these neurons become "*accustomed*" to these substances and therefore need always *greater quantities to produce the same level of satisfaction* (a phenomenon called *tolerance* or *dependence*) and this is how "*addiction*" starts;
- when these substances are not taken, the brain and the entire organism manifests a need/desire and even *suffering* depending on the substance (*syndrome of abstinence*) and therefore it becomes very difficult to stop using them (*addiction*);
- not only *chemical substances can* produce these effects: also an excessive and prolonged *stimulation* received *by the neuronal systems responsible for gratification* from the external environment (perceptive stimuli) can render us *slaves to our behaviour;*

- it is of help to be aware both of our "*ill-being*", that can become our weak points, and of our *capacity* to *compensate these by* using our own *inner resources*, those of others, and from the environment; i.e. *those psychosocial capacities necessary to take on the risks and challenges of daily life*.

These capacities, that comprise cognitive, as well as affective and communicative resources, are are defined as *life skills* by the World Health Organisation (WHO) and are identified as: *decisional capacity, problem solving, creativity, critical sense, effective communication skills, interpersonal relationship skills, management of emotions, stress management, self-conscious, empathy.*
The WHO *Mental Health Programme*, see link below, strongly suggests that educational programmes aimed to stimulate the development of *"life skills"* should be activated in schools, with the purpose of *"facilitating and reinforcing psychosocial skills appropriate to the culture and age of development, to contribute to promoting self and social development, the prevention of health and social problems, and to the protection of human rights":*
http://www.who.int/mental_health/media/en/30.pdf.
The following subject matter is dealt with initially in a general manner, and then more in detail on each specific risk of addiction: *alcohol, smoking, illegal substances, media, groups.*

SUBJECT MATTER

(In **bold**, notions or concepts to be transmitted; in *italics*, experiences to be used in the inductive teaching activities)

1 - We eat and do things for the pleasure that this gives

Not all foods are necessary for the organism

- *Remind the pupils that when they studied nutrition, they learned that our organism uses sugars, proteins, fats, mineral salts, and vitamins contained in food. Remind them that these substances, once entered into the intestines, are broken down and pass into the blood, and then from the blood to the cells through the cell membrane* (these

substances are used to build or repair the cells and to produce energy).

- *There are many other substances that we ingest that are not necessary; can you give some examples?* (draw the pupils' attention to coffee, tea, chamomile, wine, beer, alcoholic drinks, or even medicine).
- *Ask the pupils why we drink or eat substances that sometimes do not even taste good? Why are children prohibited from using some of these substances?*
- *What effects do these have on the organism? Are these effects different from food? What happens if we eat an excessive quantity of these things?*
- *Prepare a poster and list the effects grouped by category (e.g.: "it picks you up", "it makes you sleep", "it takes away belly-ache", "it makes you feel happy", "it makes your head spin", etc.), and showing possible differences when consumed in moderation and in excess.*

Some foods contain substances that influence the functioning of the brain

- *Ask the pupils to try and explain what organs of the body are affected by these substances by considering the effects that they have.* (Under various categories on the poster, add the part of the body identified during the discussion. The pupils will probably identify the brain, the nervous system, neurons, the stomach and the heart.)
- *Remind the pupils about the functions of the brain that were dealt with in Module 7,* "A journey into the knowledge, the executive mental functions", *delivered the previous years and make a list of these.*
- *Watch one of the videos with the class to understand the chemical composition of coffee, and the effects of caffeine on brain neurons:*
- *The effects of coffee on the brain:* https://www.youtube.com/watch?v=KSdB8POxmIU)
- and on the entire organism:
- *Effects of caffeine and coffee addiction:*

https://www.youtube.com/watch?v=cS88ge468HU).

The substances that act on our nerves cells also act on those of animals, provoking pleasurable reactions which they like and look for. Nerve cells become accustomed, i.e. addicted, to stimuli (both chemical and physical).

- *It has been discovered that also animals look for and eat plants or substances that they find in their environment for the effects that these plants produce.* Show the BBC video: *Animals on drugs*, perhaps only some excerpts as the video is fairly long.
  https://www.youtube.com/watch?v=pI4myzJzeSY *Comment with the pupils.*
- *Watch clips from the video Spiders and substances:*
  https://www.youtube.com/watch?v=4m0kO30m00Y
  showing the effects of psychotropic substances on a spider, that spins an irregular web.
- In animals and plants phenomena of habituation are observed when a stimulus is repeated. E.g., an amoeba stops retracting its pseudopodia when it receives continuous tactile or electric stimuli, likewise, the snail does not retract its tentacles or the *Mimosa pudica* or *Drosera* plants do not close any more when the leaves are continually touched (*Dionaea muscipula* is commonly found in plant nurseries).
- *Discuss with the children the conclusions from the previous activity* and start to prepare a poster divided into columns showing appeal, risks, and prevention from substances that modify our behaviour.

2. Alcoholic beverages: appeal, risks, and prevention from drinking them

Alcoholic beverages have been used since ancient times in all cultures; if taken in moderate quantities they may produce a pleasurable mental state.

- *With the children, look at some ancient images of convivial moments* (some are shown in the following web site)*:*

https://www.google.it/search?q=i+romani+e+il+vino&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiti-P0hYrbAhWBsiwKHdvQCowQ_AUICigB&biw=1280&bih=893

- *Comment with the pupils how wine is diffuse in countries where grapevine grows, but let them notice that different alcoholic beverages are also produced in other countries as these -can be made from fermented fruit or plant seeds.* The teachers may refer to the positive aspects of moderate use of wine and alcoholic beverages for adults as this facilitates social interaction.
- *Stress however, that modest quantities of wine can be tolerated by the adult organism, but not by a growing organism such as a child/adolescent* (not even in moderate quantities), as they have a reduced capacity to metabolise alcohol and therefore, alcoholic beverages can be harmful to them.

Alcohol is produced from the fermentation of carbohydrates (sugars).

- *Some experiments on the fermentation of fruit can be carried out (see enclosures), or the fermentation of sugar in the absence of oxygen (see video La fermentazione alcolica by the* Scuola Margherita di Savoia: https://www.youtube.com/watch?v=vY4lp2O0Prw)
- Fermentation takes time and therefore this activity can be carried out in parallel with others.
- *Construct a molecule of sugar and of alcohol using the kit of atoms used in the previous year; show the children that the components are the same, but the structure is different. So why is alcohol harmful?*
- *The quantity of alcohol in a liquid is measured in degrees* (percent alcohol present): read the labels on a bottle of wine, spirits, beer for homework.

Alcohol reaches the neurons of the brain and alters their functioning; it induces behavioural, psychological and physical transformations.

- *Ask the children if they have witnessed any changes in behaviour produced by drinking wine, beer, spirits* (*perhaps excessively*) *and how they explain this.* From a psychological perspective, alcohol makes us less timid, happier, more dynamic but also more irritable, anxious and sometimes violent and aggressive. We lose control of ourselves and there are also some alterations in our mental functions (attention, memory), so that -we are less aware of our actions which get slower, and this is the cause of many road accidents. Alcoholism worsens depression, and when it is chronic it leads to mental deterioration, delirium and dementia and finally to an alcohol-induced coma.
- *What happens to alcohol when it enters the body? In a group, try and trace the voyage of a glass of wine through the body using a large drawing of the human body on the whiteboard.* An excessive quantity of alcohol causes physical alterations to organs such as the liver (hepatitis, cirrhosis) and the pancreas. Diabetes is aggravated and alcoholics often refuse food, which creates serious problems from malnutrition. If alcohol is taken during pregnancy, it is dangerous for the child (malformation, lower birth weight).
- *Look at information on the ingestion of alcohol, its accumulation and toxicity (the teacher will select excerpts from the video: The dangers of alcohol (Piero Angela)* https://www.youtube.com/watch?v=r57n1HUfKzo&t=7s ;
- *Effects of alcohol, the science of alcohol* https://www.youtube.com/watch?v=vkYiPVfA7Sw
- *Signs of drunkenness. Why do we become drunk?* https://www.youtube.com/watch?v=omp9VGOMnl4
- *Show the video that explains how does the breathalyser test* (used by police to check if people driving vehicles have drunk alcohol): https://www.youtube.com/watch?v=HKJTKJQd9nI)

The desire for alcoholic drinks can also be motivated by climatic reasons (e.g. in very cold countries) but in most cases by a state of malaise (often not recognised), which over the long term is

itself increased by the effects produced by excessive use of alcohol.

- *Show the children a series of photographs or cartoons from the web showing young people drinking alcohol at a party,* (a woman drinking alone in front of the television, a homeless person sitting on the ground surrounded by beer cans, friends meeting and drinking at the bar in the evening, police checking if someone has drunk alcohol while driving a scooter, someone vomiting outside a discotheque, road accidents).
- *Reason with the children the motivations behind the consumption of alcohol in these various situations; ask if they have ever seen anyone drunk in real life or in a film, and what they noticed about their behaviour* (*e.g. the change in behaviour and mental functions*). Underline the alterations in perception, bodily functions, reactions and the loss of control and discuss why one should want to lose control (looking for a "buzz" considered fun by some people).
- *In the discussion, if the issue of tension comes up – either shared or individual – the teacher can try and define stress, also making the distinction between physical and psychological stress and how this can be reduced. The different methods adopted by children and by adults to cope with stress can also be compared.* Note on the Life Skills sheet: **"***Coping with stress"* **(**10.4) significant elements coming from the discussion *(see Teaching Support Materials)***.**
- *To complete this section, write on a poster useful information from this discussion, divided into three columns as follows: advantages, short-term disadvantages, long-term disadvantages from the consumption of alcohol.*

3. Smoking: appeal, risks and protection

Why do we start smoking cigarettes?

- *Ask the pupils to do a role-play. Divide the class into four groups and give each group the following task:*

i) read the situation explained in the following text, "Alberto's best friend Giorgio comes to visit with his older brother. Alberto's mother has to go out briefly and so she leaves them alone. She tells them where to find something for a snack and shows them a new video to watch. On the table there are some cigarettes that the father had forgotten. What will happen in the half hour that the mother is absent? What do the characters say?"

ii) write the continuation of the story as they wish, indicating the people and the parts to be played. Each group will present their own story. At the end, the stories will be commented and discussed.

- *Propose the activity (1.7) from Life skills: "The way I feel, The way I behave".*
- *Ask the children to interview members of the family that smoke: why did they start smoking? When? Why did they continue? How much did they use to smoke and how much do they smoke now? Decide in a group how to format the sheet to record the answers and the age of the interviewee. Gather all the results on a poster to discuss these, and to reach some final conclusions. e.g. some other questions to be asked to the adult could be: "When do you feel the strongest urge to smoke? Have you tried stopping? Why is it difficult to stop?"*

Cigarette smoke is made up of many different chemicals that enter our bodies and reach different organs.

- *Ask the children to draw and describe the journey of cigarette smoke in our bodies.*
- *Proposed an activity that shows how cigarette smoke from the combustion of tobacco and paper leaves visible tar deposits (Video: Experiment on dangers of smoking*
- *https://www.youtube.com/watch?v=A_zEZaNjRYo&t=76s*
- *The video will show to the teacher how to carry out the experiment).*
- Chronic smokers have much more serious problems with the respiratory organs such as recurrent bronchitis, respiratory insufficiency, emphysema, lung tumours than non-smokers.

- *Watch the video on YouTube* ***Damage caused by Smoking,*** *produced by Fondazione Umberto Veronesi* https://www.youtube.com/watch?v=IfGTOj66IWI, *that shows the composition of cigarette smoke, the molecules of nicotine, and illustrates the pathway of smoke inside the organism. The molecules of nicotine pass into the blood, reach various organs and provoke different effects.*

Smoking becomes a habit that is difficult to change. Addiction is not only caused by substances but also by situations.

- *The teacher will examine the answers given by adults in the interviews and highlight that many smokers are not only addicted to the substance* (nicotine), *but there is also behavioural or habitual addiction, e.g. the need to always have something in their hands or mouth* (electronic cigarette, like a baby's pacifier). *There are also special situations that increase the desire to smoke.*

- *Ask the children to write something about their habits. After reading what the children have written, start a conversation on: "What are habits? How/why do they start? How much do we change? What are the advantages and disadvantages of habits? If you don't follow your habits* (time, food, play, favourite programme), *what happens?".*
- *Discuss with the children the conclusions and what can be learnt from this activity, adding any findings to the poster already made for the immediate, short term and long-term advantages and disadvantages for smoking.*

4. Drugs: appeal, risks and protection

All people, even from different cultures have used plants from their environments that are able to alter the mental functions and produce a distorted perception of reality.
In some societies where daily life is precarious, some drugs are taken to lessen the burden of hunger, fatigue, or pain.

- *A typically example is the use of khat in Ethiopia and Somalia, which is thought to increase resistance to fatigue and hunger.*

In developed societies some drugs are taken to improve performance in sports (doping), to appear fit and healthy, for boredom, to overcome a lack of self-esteem, to escape from reality and not face problems... and for many other reasons.

- *In the following discussions, the teacher should elicit the pupils' knowledge on the use of drugs and their opinions towards this issue.*
- *Give the pupils a story to be completed. The story has three variations, but unknown to the children. Divide the class into three groups and give each group one version of the story.*
- *Story: "You have gone to a shop near home to buy a new schoolbook. On a dark corner, you see a schoolmate give some money to another young boy; he takes something from him and then leaves rather hurriedly. You realise that your schoolmate saw you, but he has gone in another direction. You meet your father on his way home (variations: you meet your mother*; *at that moment another schoolmate passes by*; *you meet your schoolteacher*)."
- *Compare the finished stories from each group and reason on the decisions taken by the protagonist regarding the identity of the person that s/he meets.*

Drugs create addiction

*Watch the video "**Addictions**"* https://www.youtube.com/watch?v=P-Sypm-Q2UE *and discuss with the children their comments.*

Friendship, affection or reciprocal trust offer us external resources (not found in ourselves) to overcome difficult situations.

- *As part of the activity on Life skills, propose that the children read "The Little Prince", chapter XXI.*

- *Give them some time to reflect (if they want, they can write down their thoughts) on the meaning of what they have read and then share their findings.*
- *The teacher will underline that sometimes it is difficult to express feelings, sentiments and sometimes the other person is not able to understand our mood, because they are distracted, because they are not used to observing this, or sometimes because they don't want to become involved, etc.*
- *From the activities on Life skills, the teacher can propose some of the following activities: "Recognising other people's feelings" (8.1), "Recognising feelings" (8.2), "Signals of attention" (8.3)*
- *Discuss the children's conclusions from these activities and add them to the poster on alcoholic beverages and smoking, indicating the immediate, short term and long-term advantages and disadvantages of drugs.*

5. TV, phone and videogames addiction: appeal, risks and protection

We all use electronic devices for various useful and fun activities. How much does this involve our mental functions and capacities?

- *Ask the children to make a short survey on video games that they like and prepare a small questionnaire to exchange with other Year 5 classes to agree on a standard model, that can be distributed to Year 4 classes. Their questions might be similar to these: What are your favourite games and what you play at the most? What do you use to play (computer, cell phone, PlayStation, tablet, etc:)? What you like about your favourite video game? Do you think you're a good player? How long do you spend each day on video games? When (morning, afternoon, evening) you play during the day? Is there any difference between school days and weekends? Do you play alone or with someone? These results will be put into a table and discussed.*
- *Prepare a poster on the TV divided into four columns: WHEN, WHAT, WHOM WITH, PREFERENCES. Ask the*

children some questions on how they use the television: When you watch it? For how long? What programmes do you watch? Whom with? What you like best? Write down the answers on the poster; identify some conclusions and discuss them.

- *The teachers prepare a large chart to be displayed in class and with columns for television, computer, cell phone and tablet, PlayStation* (*see Teaching Support Materials: Sheet 1, taken from "La main à la pâte"*). *The teacher will ask the class: Do you remember the functions of the brain that we spoke of last year? Perhaps they will remember, or they can be helped by the teacher: perception, memory, attention, learning, imagination, emotions, communication. Write the above functions of the brain in the first column to the left.*
- *What functions do you think are specifically stimulated by each of these devices? The functions that are stimulated by each instrument is indicated underneath.*
- *The teacher can ask the children to dedicate a new page in their SCIESA workbook to "things to remember to use electronic devices correctly". On finishing all these activities, the children will write some conclusions and suggestions for good practice in the use of these devices referring to the poster "Electronic devices".*

Concentration on the screen prevents one from noticing what is happening around or even one's own needs (physical activity, sleep, social relationships)

- *Show the class the video taken from the site "La Main à la pâte":*

https://www.youtube.com/watch?v=IGQmdoK_ZfY&feature=youtu.be

- *Comments the video. To start the discussion, the teacher can ask "what could happen if we were so concentrated on something to not realise what is happening around us*?". *This questions should elicit reactions from the children which make reference to their daily lives:* "sometimes when I'm playing at football and concentrating on the game, I don't

realise that another player has fallen", "when playing a video game, I don't hear my sister when she calls me", "when I'm reading, I don't like anyone speaking to me because it distracts me".

- *The class can then decide on some general phrases to summarise these reflections; these phrases can be written on the whiteboard and in the children's workbooks*. For example: "When we are concentrating, we don't realise what is happening around us".
- *Ask the children to keep a diary for a week on how they spend their time; physical activity (not only in the gym), sleeping, interpersonal relations with friends and family (specify the activity carried out). See Sheet 2 as a model.*
- *Compare the children's diaries and make a chart to summarise the average times for each activity; comment the results, the differences between children, the correspondence between time dedicated to activity and desire or necessity. Compare this chart with the one prepared at the end of the previous activity.*
- *The teacher can ask if the children move when they have been sitting for a long period of time in front of a screen; what movements do they make and with which parts of the body. Ask the children to observe someone at home (sibling, parents) when using the computer or tablet, or playing a video game and asked them to read their written observations to the class. Movements, gestures and the use of senses indicated will be commented and compared with the physical activities that the body needs for its well-being*.
- *The teacher will distribute to each child Sheet 3, taken from "La main à la pâte" and asked them to colour the portion of the "pie chart" using the information regarding for sleep, and following the instructions indicated on the sheet.*
- *Show the children Sheet 3bis, "What happens when we sleep too little?" As we said in the mini module "Too much and too little", during sleep the brain continues to function (dreams) and to learn by elaborating experiences and*

information received during the day. Sleeping little makes us feel tired, irritable, inattentive and creates problems with memory.

Direct communication with people is made not only with words, but also with facial expressions and body language which all facilitate clear comprehension.

- *Play a communications game with pairs of children:*

Communication using devices can easily produce a false interpretation of the message and the intention of the sender.

- *What are the devices that we usually use for communication at a distance* (*telephone, post*).

Communication using computers has both risks and advantages.

- *The teacher can divide the class into groups and give each group a copy of Sheet 5, taken from "La main à la pâte"; ask the children to observe carefully and try and explain what they think the people are doing. Share their interpretations with the class. The teacher can animate the discussion with questions such as: Are these people together in the same place? What are they communicating? Do some of them meet during the day? What is it that lets us communicate through the Internet? What you think of the use of pseudonyms? What does the wolf want to do?*
- *The teacher will then distribute to each group a copy of Sheet 6 taken from "La main à la pâte" and will ask: "What does this mean? How was this international dessert made"?* This discussion should bring the pupils to realise that telematic communication is an opportunity to share information in real-time, to cooperate with people in other countries, to maintain contact with far away friends and family.

Understanding addiction to electronic devices and reflection on direct experience

- *How do you feel when your mother makes you turn off the computer, or limits the time you spend on the tablet or cell*

phone on some occasions (when eating) or for some days? What happens or what reactions have you seen in friends or older siblings? What do you miss?

6. Addiction to groups

Reflect on direct experience within the class, within your group of schoolmates, of friends to understand the relationships within a group and why these exist.

- *The children experience social relationships with their peers and also with adults, but they don't have the occasion to reflect on their behaviour in different situations, and also the motivations behind the choice of groups. The teacher will introduce the argument with a rapid brainstorming activity (free discussion) and will propose the activities of Life Skills on interpersonal relationships: "Features" (7.3) and "The Group"* (*7.8*)*, which will give input and stimuli for further comment:*

Becoming aware of mechanisms that exist in the relationships between members of a group: socialisation and conforming to the rules of the group, imitation and loss of autonomy. Sometimes we follow the ways and preferences of a group of children because we are afraid of not being accepted or being excluded.

- *Propose the following situation:*
- "A group of children are in Luca's house for his birthday. After a little while, some pairs of children start to play a videogame to see who gets the most points; others are concentrated on their cell phones. Matteo does not have a cell phone or a tablet. Andrea asks him to play on the PlayStation, but Matteo doesn't want to because he's afraid of not being quick enough and are not scoring enough points). *Have you ever found yourself in a similar situation? What would you do if you were Matteo? What would you do if you were Andrea?*
- Divide the class into groups: each group will prepare a brief script "to be acted out", giving each other a role.

- *Follow each presentation with a brief discussion to highlight any aspects that come out of the role-play.*
- *Ask the pupils to write a story on a personal experience with the title: "The time I decided to react and tell you what I thought", or "I had the courage to do what I wanted".*
- *Compare and comment the stories, highlighting any differences or similarities in the situations, the motivations behind the autonomous action, and the emotions that accompanied this decision. The teacher can explain what factors may impede us in behaving autonomously.*
- *To continue the discussion on autonomy, the teacher will give the children some questions to be answered in writing as homework: "Are there are some games that you like but you keep these hidden because you might feel too little compared to the rest of your friends?"*
- *It is your birthday party. Who are you going to invite? Who decides the invitations: your parents, other friends?*
- *How do you choose your clothes? How do you choose the television programmes to watch? Do you decide, or your parents, or your friends?*
- *After reading the written answers, the teacher will make a summary for discussion.*

Discuss with the pupils that the acquisition of autonomy is also an individual responsibility, and it is achieved through taking risks and experiences that put us to the test.

- *From the activity on Life skills: Level of discomfort* (*7.2*).

TEACHING SUPPORT MATERIALS

Video on *Attention* taken from the website "La Main à la pâte":
https://www.youtube.com/watch?v=IGQmdoK_ZfY&feature=youtu.be

Instructions for using the video

The teacher will explain to the pupils that the video shows two teams that are passing a ball. The children will have the following assignment: "count the number of passes made by the players in white football strips. Remain in silence until the end of the video".

At the end, the teacher will ask how many passes were counted. Then the teacher will say: "Did you notice anything else in the video? What else happened that didn't involve the players?" Someone will saying that they saw someone dressed up in a gorilla costume, but others will not have seen this. The teacher will open up the discussion; probably the children that counted the most passes did not see the gorilla.

"Why didn't you see it?" The children will probably reply: "We were concentrated on the players with the white strips and counting how many passes they were making".

The teacher can ask the children that saw the gorilla if anything else unusual happened during the video.

Probably no one will realise that the backdrop changed colour from red to yellow, and one of the players in the black strip abandoned the pitch. At this point, show the video again so that everyone can see it, and the teacher will animate the discussion with the following type of comments: "How did you not notice this?" In daily life are we sometimes so concentrated on something that we don't realise what is happening around us?

The class will write a sentence that summarises the reflections generated by the video.

Sheet 1

Some devices that make use of a screen / Write in this column the brain functions that, in your opinion, are most likely activated when using these devices	 Television	 Computer	 Cell phone	 Video games console

SUGGESTIONS FOR SHEET 1

The teacher attaches on the blackboard a copy of Sheet 1 representing different types of screens. He then asks the class: "Now you will tell me what are the functions that our brain performs, and I will write them in the left column of the card". Having done this, he will ask: "Now tell me: what are the functions of our brain that, in your opinion, each of these objects drawn above stimulates?" To animate the discussion the teacher can ask specific questions: "for example, what does our brain do when we watch the TV screen?"

La main à la pâte

Write in this column the brain functions that, in your opinion, are most likely activated when using these devices / Some devices that make use of a screen	 Television	 Computer	 Cell phone	 Video games console
Perception (seeing, hearing)	X	X	X	X
Attention	X	X	X	X
Memory	X	X	X	X
Learning	X	X		
Imagination	X	X	X	X
Communication		X	X	
Moving around				X sometimes
Emotions	X	X	X	X
Making your body live (sleeping, eating)				

These questions, repeated for each of the screens, serve as a basis for a discussion in the classroom. The teacher progressively marks on the sheet, in the corresponding box, the ideas of the class. Some choices may be unanimous. For example, all these screens show us images, let us hear sounds, and therefore stimulate our perceptions; some may perhaps dampen this statement, emphasizing that not all senses are stimulated, e.g. taste. Or again: "*some video games make the whole body move, while in front of the television one stands still*". Some pupils might then object that "*we move in front of the television, and we can also do gymnastics*". Another example: "*the screens allow us to communicate*", "*one gets the impression that people who are focused on the screen are isolated*", "*but at the same time the internet allows us to discuss with others, and there are video games which can be played in many* ".

Sheet 2

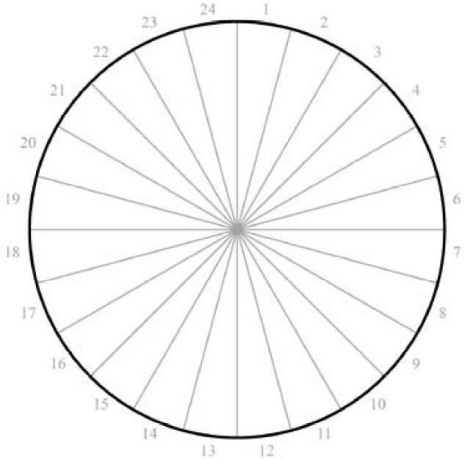
Days	*Sleep*		*Movement*	*Activity with others*	*Activity with parents*
	I went to bed at…	The next day I woke up at…	Time spent doing physical activities (also specify which ones)	Time spent with friends (specify which activities done together)	Time spent with parents (specify activities done with them)
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					
Day 6					
Day 7					

SHEET 3

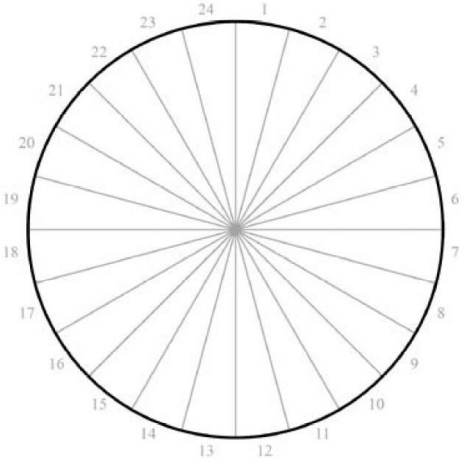
How many hours do we sleep?

One day lasts 24 hours. To have an idea of what part of a full day your sleep covers, do colour as many "pie slices" as are the hours you spent sleeping. If it isn't a whole number (e.g. 10h 30min) you may colour a half slice. If each night you slept the same number of hours, use the right pie only.

This week my shortest night was of ... hours

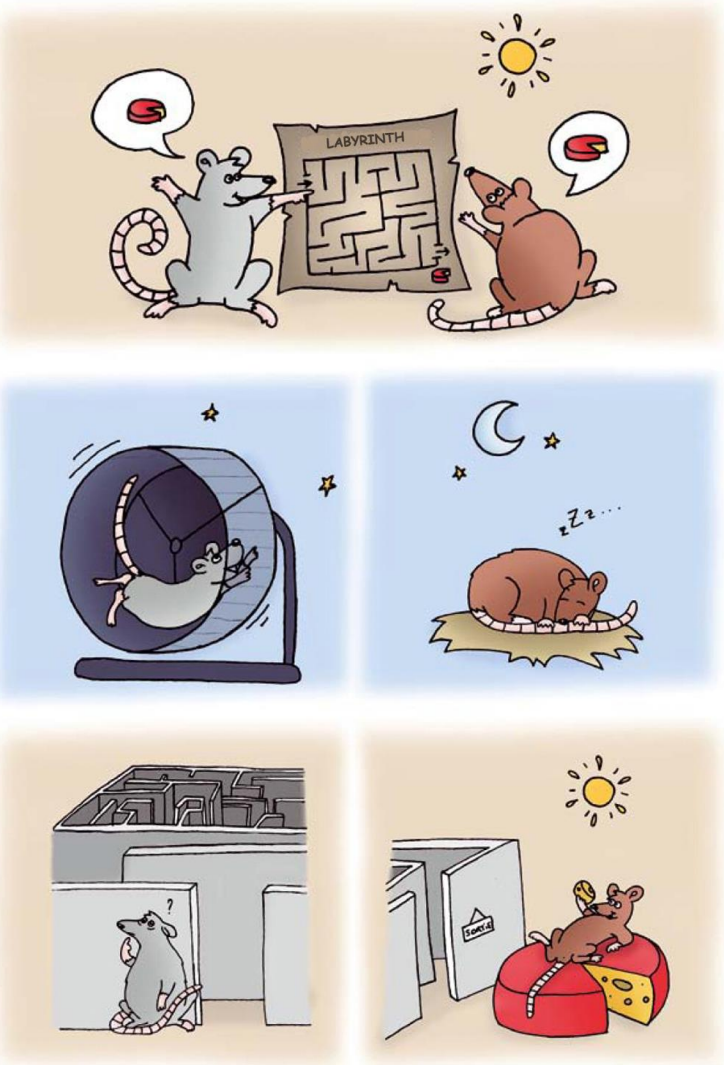


This week my longest night was of ... hours

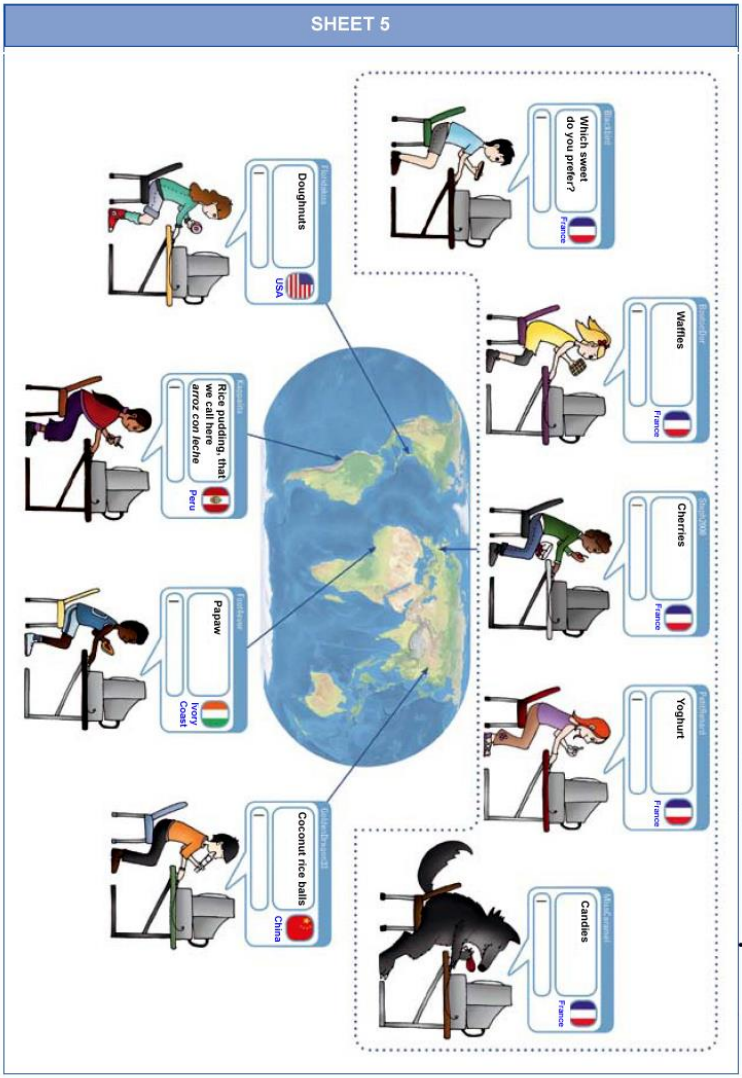


Sheet 4: Sleep helps the brain functions.

SHEET 4

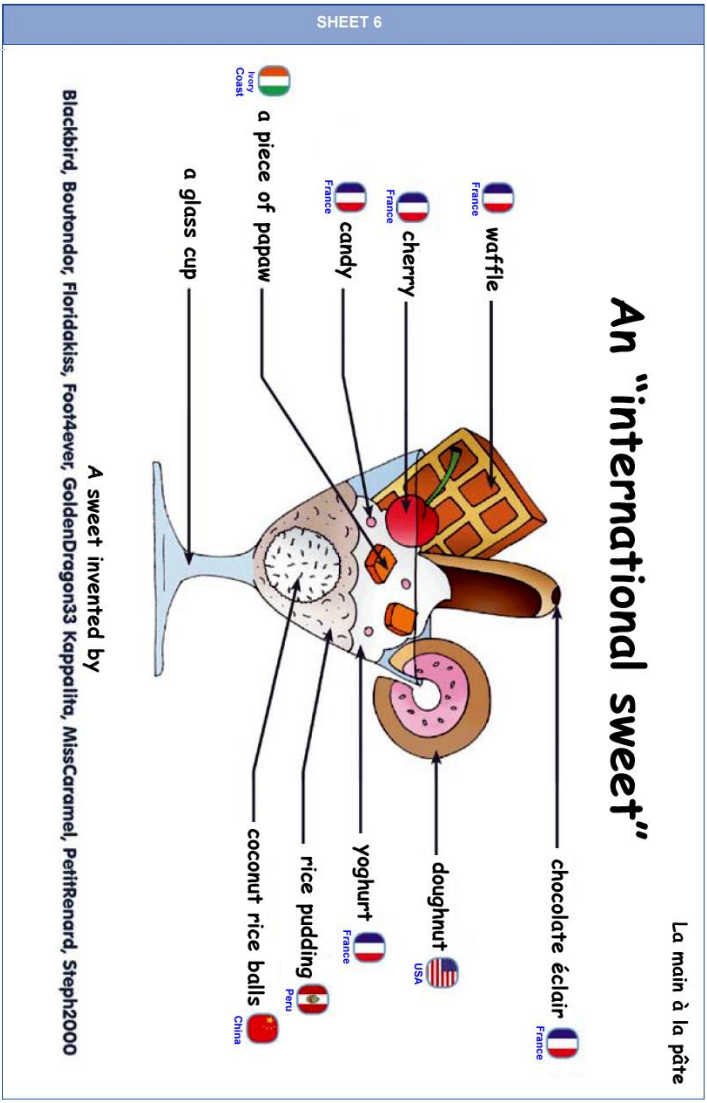


Sheet 5



La main à la pâte

Sheet 6


SHEET 6
La main à la pâte
An "international sweet"
waffle
France
cherry
France
candy
France
a piece of papaw
Ivory Coast
a glass cup
chocolate éclair
France
doughnut
USA
yoghurt
France
rice pudding
Peru
coconut rice balls
China
A sweet invented by
Blackbird, Boutondor, Floridakiss, Foot4ever, GoldenDragon33 Kappalita, MissCaramel, PetitRenard, Steph2000

10.4 COPING WITH STRESS

Which elements have come out of the brainstorming that are meaningful to you?

……

……

……

……

……

……

……

……

……

……

……

……

1.7 THE WAY I FEEL, THE WAY I BEHAVE

Answer to the following questions and then compare your answers with those of your class-mates

1. Mother left you at the home of friends. The big brother of one of them proposes that you all go to a *Games Room,* which is not far from the house, without saying anything to the parents.

How do you feel?

.....

How do you behave?

.....

2. End of the school year: A class-mate and your girlfriend proposes you not to go to school, but you were expected to bring to the teacher a homework that you had not done the day before.

How do you feel?

.....

How do you behave?

.....

3. A friend of yours tells you that he started smoking. He asks you to try with him, because it is really beautiful and makes you feel great

How do you feel?

.....

How to you behave?

.....

You're with a group of friends at the supermarket. One of them proposes each of you to steal a small object. Everyone agrees.

How do you feel?

.....

How do you behave?

.....

2004, P. Marmocchi, C, Dall'Aglio e M. Zannini, *Educare le life skills*. Trento, Erickson

EMPATHY

8.1 RECOGNIZING OTHER PEOPLE'S FEELINGS

Look at a person in the room (or at more people). How can you understand his/her feelings without them being communicated to you?

Name of the observed person

.....

Feelings of that person

.....

.....

Signals you have observed

.....

.....

Name of the observed person

.....

Feelings of that person

.....

.....

Signals you have observed

……

……

Name of the observed person

….……

Feelings of that person

……

……

Signals you have observed

……

……

2004, P. Marmocchi, C, Dall'Aglio e M. Zannini, *Educare le life skills*. Trento, Erickson

EMPATHY

8.2 RECOGNIZING FEELINGS

Which feelings have you decided to express? By which channel? And your class-mates?

Feeling	Channel
……	……
……	……
……	……
……	……
Feeling	**Channel**
……	……
……	……
……	……
……	……
Feeling	**Channel**
……	……
……	……
……	……
……	……

EMPATHY

8.3 SIGNALS OF ATTENTION

Answer to the following questions and then compare your answers with those of your class-mates.

Which attitudes of the other person let you understand that he is not interested in what you are saying?

.....

.....

Which attitudes of the other person let you understand that he's listening to you?

.....

.....

Which attitudes let you understand if the other person no longer wants to talk?

.....

.....

Which attitudes let you understand that the other was impressed by what you said?

.....

.....

Which attitudes let you understand that the other is thinking of something else while you are talking to him?

.....

.....

Reflect on the answers you gave. How many of these attitudes are also *yours*?

.....

.....

What could you do to improve your ability to empathize with the other?

.....

.....

INTERPERSONAL RELATIONSHPS

7.3 Features

Which character features are, in your opinion, useful to live well in class, in your group of friends or in the family? Among the features that are listed below, choose three that, in your opinion, facilitate and three that interfere with relationships.

funny	**good**	**messy**
risk-lover	**different**	**ambitious**
insistent	**careful**	**discreet**
the best	**aggressive**	**creative**
reflective	**deductive**	**productive**
tolerant	**trustful**	**obedient**
honest	**collaborative**	**diligent**
curious	**silent**	**sincere**
competitive	**talkative**	**self-confident**
sociable	**generous**	**spontaneous**
unpredictable	**good listener**	**sensitive**
intelligent	**charismatic**	**available**

IN CLASS

Facilitates……

Interferes……

WITH FRIENDS

Facilitates……

Interferes……

IN THE FAMILY

Facilitates……

Interferes……

INTERPERSONAL RELATIONSHPS

7.8 THE GROUP

Reply to the questions below, then match your answers to those of your class-mates.

In my group of friends I like best

……

……

……

……

……

……

In my group of friends I don't like

……

……

……

……

……

I feel similar to them for

……

……

……

……

……

……

I feel different from them for

……

……

……

……

……

……

INTERPERSONAL RELATIONSHPS

7.2 LEVEL OF DISCOMFORT	-2	-1	0	+1	+2
1. Revealing to others what I do not like about myself					
2. Ask for help to solve personal problems					
3. Express my anger towards a partner					
4. Accept the affection by someone in the group					
5. Ask for an opinion about me from important elements of the group					
6. Show that someone in the group is my best friend					
7. Say something that might irritate					
8. Intervene to resolve the conflicts that arise in the group, make peace					
9. Be at the center of the group's attention					
10. Be insecure and confused in front of the group					
11. Admit to be wrong about something					
12. Talk about sex					
13. Admit to have been wrong about someone in the group					

14. Expressing indifference towards the other group members					
15. Saying what feelings give to me the physical appearance of another member of the group					
16. Admit that someone in the group has hurt my feelings					
17. Tell others in the group to leave me alone, "to get out of the way"					
18. Leave the group in times of stress					

EVALUATION OF COMPLETED WORK

PREMISE

Curricular teaching and, in addition, the evaluation activities that need to be performed during the fifth, and final, year of the primary school cycle are particularly time-consuming and complex, involving both the teachers and the National Evaluation System. For such reasons, the Modules that had been prepared for the SCIESA project were not given the needed school time as in the previous four years, but met with considerable temporal limitations; similar limitations were encountered in implementing adequate SCIESA final evaluation tests.

The final Module, which focused on the nature of the different types of health risks and on the skills to be developed to face them, offered numerous stimuli for group or class discussions, aiming to arrive at shared reflections on situations, behaviours and emotions. Such type of activity, in itself quite difficult to achieve and to evaluate, would have required ample times and repeated processing of the awareness level reached by the pupils. Unfortunately, the conditions were not available for it to be carried out according to the modalities envisaged, due time restrictions. We administered two tests only: a questionnaire with open questions concerning the entire five-year SCIESA project and a list of "sentences to discuss", taken from the book "*Prevention in Adolescence*" by S. Bonino e E. Cattelino, Erickson, 2008, adapted to the age of the pupils.

In summary, the documents examined for the evaluation of the fifth year activities were the following:

a) observations taken from the minutes prepared by the experts during class visits;

b) analysis of the two tests given to the pupils at the end of the school year;

c) evaluations and comments on the SCIESA Project through a questionnaire proposed to parents;

d) evaluations and comments by the teachers, as reported in the logbooks, meetings with the experts of the SCIESA group during

the year, including final written comments from the teachers to evaluate the strengths and weaknesses of the whole project;
e) presentation of the *Tree of Life* made by the pupils to their parents in a meeting held at the end of the school year.

a) Observations made by the experts during class visits

1. The changes
An important change took place in the classrooms of the Via Asmara school: classes IV A and IV B were grouped into a single class of 16 pupils with three teachers, because in IV A there were only 6 students, all of foreign origin. The classes of the via Novara school had an increased number of students, to 25 in V C, and 25 in V D.

2. What pupils remember about the previous year activities
As in the previous years, the experts, together with the teachers tried to understand whether the SCIESA project had been identified by the pupils as separate from the standard curricular school program and what they had been able to master from the Modules delivered during the previous year.

What pupils referred about such issues clearly showed that the project and its aims had been clearly identified ("*SCIESA helps us understand how our body works"*) and that the understanding of the modules contents was deeper when the pupils had been directly engaged in practical experimental activities. They were able to remember and to describe experiments performed in the previous year, such as the observation of the cells under the microscope, the experiments with a chicken egg dipped in vinegar to show the membrane underneath the shell and its permeability, an analogous experiments with potatoes, the experiment realized by measuring and comparing the surface of the large cube with that of the many small cubes coming from fractionating the large one, an experiment aimed at making the pupils understand the progressive increase of the cell surfaces of an organism consequent to cell division. Experiences on sounds and smells were well remembered as well.

Experiences done during earlier classes are also mentioned, such as the observation of a real heart and of a brain, the pathway followed

by food in our body, the presence of an acid in the stomach, the experience with the tea bag, a dramatization of the blood journey into the human body done by the pupils etc.

About the molecules and atoms that form the matter: - *the molecule is bigger than the atom and held together by bonds that can be weak and strong*. Teacher: - are the molecules the same? - *no, because they are made up of several atoms and various types of atoms; - matter is made up of molecules.*

In many cases the final aim of the experiments performed was not perceived by all the pupils. Only some of them were able express concepts such as: *the egg is a cell, the membrane has small openings where food enter, what we have observed is called osmosis.*

These results appear to confirm that teaching has to be primarily focused on experimental activities. Also, adequate time is required for progressive adjustments of experimental procedures, to be performed on the basis of the observations coming from the discussion with the pupils. All of these activities require an expert mediation by the teachers.

3. What pupils know about health risks and well-being.
Introductory conversations to Module 11 made it quite clear to us that pupils were already fairly aware of the risks they might face in the environment where they live and, at least in part, of the causes and the psychological mechanisms underlying risky behaviors. They know risk factors such as: *bullying, bad company, refusing food, stealing, walking around on their own, working problems, drugs, alcohol, accidents, thefts, obesity, "being obsessed with mobile phones and videogames", "failing at school; wrong friendships, friends that talk behind my back*".

Through family experiences, they know that people smoke despite knowing that smoking is dangerous for health. To the question: "*Why do we not behave coherently with what we know?*" they are able to name many of the reasons that may influence their choices, actions, and lifestyle, such as: *the will, the commitment, laziness, not being*

aware, commercials, your own personality, it depends on how you feel, etc.

They relate the desire of young people to smoke with emotional motivations: "*bragging, imitating the father, willingness to appear adult, being carried away, feeling superior, not to be teased, making friends with those who smoke, smoke as a stress reliever*".
Risks may be attractive because "*everyone does it; it's a fashion to do it, you imitate friends, you feel like a member of a pack; you become dependent"*.
Pupils feel that sometimes they are being pressed to do things they are not eager to do, such as: *to wear elegant dresses*"; sometimes they feel lacks: *"of time; of the father who is abroad; of the mother who works night shifts; of companionship; of grandparents who are gone"*. One of the kids says he has: "*never been able to see his father and mother together when he was a child; he misses his father"*.
They have already experienced verbal violence (e.g. at the stadium), the offence and arrogance of older pupils, even friends or brothers. They have begun to use defensive strategies: *"in order not to quarrel, I try not to put myself in opposition; with different people I speak with different faces"*.
Some recognize that they have learned how to control anger, which they vented on things or people when they were younger.
Concerning their life environments, pupils express fears about diseases, unpleasant people, darkness, animals, the *middle school*, i.e. the school cycle they will move to next year, with the new, expected problems: new subjects to be studied, the relationships with new teachers, less free-time available, chances of having to deal with bully boys, or boys who take alcohol or drugs.

The whole of these topics have been discussed again during the class work on Module 11. We noticed on this occasion that, possibly as a consequence of the extensive work done with previous modules on body functioning and on body-mind-environment interactions, pupils were able to recognize physiological and psychological factors that may be connected with alterations of the health state.

For example, about anorexia:

Teacher - *What happens when you eat too little*? - *Muscles are eaten, blood is no longer rich*
Teacher - *Why are there people who quit eating?* The answers to such question refer to the fact that boys and girls are sensitive to other people evaluation, their own physical appearance, fashion, exclusion feelings, humiliation feelings.
About the consequences of assuming stimulating substances, they appear to have learned that alcohol damages the brain, even coffee causes damage, in cigarettes are present more than 4000 harmful compounds, in Coca Cola there are 21 different sugars!
With regard to *addiction,* they recognize their "addictions" to chocolate, chips, peanuts, Mc Donald's, computer, cell phone, but they do know the differences between these and "much more serious" addictions, alcohol, cigarettes, substances of abuse and the influence that addictions may have within a group:

- *there can be addiction to many different things, even to the PlayStation*
- *but everyday addictions are different, being addicted to chocolate is different from being addicted to drugs!*
- *if everyone is playing a game and you're not, it's not a good thing;*
- *being addicted or not, it all depends on the choices you make*
- *one can be addicted to one thing and not to another one*
- *with the Playstation one should play a maximum of 45 minutes to one hour. I turn it on only on ... (he mentions the days of the week) not the other days, you have to detoxify yourself*
- *when I went back home the other day, I told my father not to smoke because it was ... it could be very dangerous*
- *I'm addicted to all things electronic ... well when I'm with friends I'm a bit 'more ...*
- *I'm a bit dependent on my brother.*

Self-regulation behaviors are also mentioned. Interesting is the discussion following the comment of a child: *"pupils must be supervised",* and the reaction of another: *"a person must be followed, but up to a certain point"*. The discussion concerns the need to

prevent dangerous mistakes and behaviors and the consideration that personal experience teaches with greater effectiveness how to avoid the dangers: *"at a certain point one learns by himself: if the parents are too protective, the pupils never learn"*.

b) **Analysis of the written tests**

1. Questionnaire

A questionnaire was prepared to be submitted to the pupils of the experimental group and to control classes at the end of the fifth grade classes. The questionnaire (*see at the end of the section*) included 18 open-ended questions concerning a selection of the main topics that had been treated in the modules of the SCIESA program (Module 11 excluded); such topics are also present in the national science curriculum.

Only two fifth-grade classes, to a total of 45 pupils of the experimental classes, all sharing the same socio-economic context, were available as a control group in the two schools. The teachers were responsible of administering the questionnaire to their pupils. One hour and 30 minutes was the time set for the accomplishment of the task. The researchers were present in the experimental classes only. The experimental group included 66 pupils and the control one 45 pupils. To make the performances of the pupils comparable it was therefore necessary to equalize the two samples: to such purpose, 46 questionnaires were randomly selected out of the 66 questionnaires filled up by the experimental group.

Grids were conceived to allow for a qualitative analyses of the replies, performed by two independent evaluators who then discussed the discrepancies emerging from their analyses. Our procedure was not aimed at simply checking the right/wrong propositions present in the pupils' replies, but rather at extracting from them the elements that could provide evidence that the main learning objectives of the SCIESA project had been achieved or approached.

Whilst the order of the questions in the questionnaires followed the modules' sequence, our analysis clustered the pupils' replies into four thematic areas: *environment*, *organism*, *brain/mind*, *health*. The

overall scope of the SCIESA project and of its didactic units was indeed to foster the cognitive construction in these conceptual areas for attaining a systemic view of the interaction between humans and the complex environments where they live, as well as between biological and psychological components of the body. An idea of health as a state of well-being depending on these interactions is envisaged as resulting from such awareness.

ENVIRONMENT (Questions 1, 2, 13)

Through the grid analysis we tried to obtain evidence on whether the pupils had gained a wide-ranging concept of environment, differentiated as physical, social and cultural, related with organisms capable of perceiving sensations, thinking and having emotions. The parameters considered were: which and how many environments were mentioned in the replies and which were their characteristics; which kind of relationships with environmental components were mentioned. We have also noticed the replies referring to "a pleasant environment". 67% of the pupils in the control group and 46% in the experimental group include more than three characteristics in the list. The majority of the replies from the *control group* refer to natural environments, and only a few of them mention the presence of people, friends, or play-mates as a component of the environment. Only half of the characteristics mentioned in the list belong to tangible qualities such as colours, odours, silence, whilst the absence of violence, pollution, cleanliness are frequently present in the lists. The possibility of relaxing is also frequently included as an aspect that contributes to make pleasant an environment.

The replies from the *experimental group* list environmental qualities that may characterize both urban and natural environments, the last ones not being the prevailing reference, as it is confirmed by the replies to Question 2 (*Think of a specific environment etc*.). All the replies include at least one tangible quality: not just colours and odours but beauty, warmth, music, silence, peacefulness. Social components, and features related with them, are also very frequently mentioned: friendship, mutual respect, support from people, likable people, order, precision, liveliness, cheerfulness.

The awareness of the social network emerges also from the replies of both groups of pupils to Question 13: social components appear in 29% in the control group replies the and in 24% of the experimental group's.

ORGANISM (Questions 3, 4, 5, 6, 7, 14, 15)

The parameters included in the grid used for the analysis of the replies aimed at finding out how the pupils' concept of organism had evolved, rather than acquired notions about the components and functions of the body and the use of correct specific terms (e.g., alveoli, intestinal villi, enzymes, etc.).

The following parameters, if present in the pupils' replies, were considered as evidence of this conceptual evolution:

- the inclusion of brain and eyes among the body components that are involved in the two kind of actions mentioned in questions 3 and 4 (throwing a ball to another person, walking);
- mentioning the transfer to the blood of inhaled oxygen, and its destination to all the parts of the body up to the cells;
- food assumption viewed as a process of transformation, selection and distribution of simple molecules to all parts of the body, up to the cells;
- linking food transformation with energy production;
- mentioning the circularity of the blood journey inside the body;
- arranging the correct hierarchical dimensions of organism, organ, cell, molecule, down to atom.

The analysis of the replies shows differences between control and experimental classes concerning some of the above parameters and on how they are formulated. In addition, relevant differences were found between the performances of the two control classes: the replies from the class in the school located in via Asmara bear evidence of a less articulated knowledge and comprehension. The between-school differences are less remarkable for the experimental group classes.

No differences were found between control and experimental groups concerning the respiratory function, mainly its physiological meaning: less than 50% of the pupils were able to clearly state the final destination of the oxygen, in a generic form: ”it goes to the whole body”, or in a more specific form: “it reaches the cells”. Similar result were obtained concerning the destination of the journey of the blood (Question 7): only 36% of the replies in the control and 39% in the experimental group mentioned organs or the whole body. Likewise, the cells very rarely appear as final destination of the nutrients, with a slight positive difference for the control group.

It is to be underlined that these observations are in apparent contrast with the fact that the pupils in control classes are able to specify in detail and with a correct terminology the series of organs that make up the digestive or the respiratory systems and it is also in contrast with their higher awareness of the circularity of the blood journey. The replies of these pupils seem to imply that air (or oxygen) and food go in and get out the body through a chain of specific organs in a process being an end in itself. Their descriptions of the organs and systems – very similar among all control pupils – appear, however, as a sort of recital of memorized school textbooks, particularly in the sample of pupils from the control classes in via Novara.

The majority of the pupils in the experimental classes write short replies, that are poorly informative about the notions concerning the organs and their specific functions. On the other hand, these replies are not uniform, contain less stereotypes and try to explain the facts in one’s own words, even taking the risk of mistaking. In this respect, the replies to Question 5 are emblematic. We did find synthetic propositions in response to the question “what happens to the food we eat”, such as: “*it is transformed into simple substances*”, “*it is decomposed*”, “*it turns into nutrients for the cells*”, “*some parts are given to the cells*”, “*it is melted by acids*”, “*it is filled up with sour substances*”. This “style” is confirmed in the replies to Question 15 as well, concerning what happens to the sugar when put into water. This question intended to check the effectiveness of the

pedagogical approach that had introduced many laboratory-activities in the teaching units for promoting direct observation of phenomena and reasoning about observable facts. Many more pupils (15) in the experimental *vs.* in the control (2) classes mention the molecules, but most of all they try to provide reasoned out explanations from what they had observed rather than to use expedient-words like "*it dissolves*", "*it is a solution*". Pupils write: "*The water has absorbed it*", "*it has de-materialized*", "*it is evaporated*", "*it became smaller*", "*it has decomposed*", "*it transformed*", "*its links are less joined",* "*it has taken the colour of the wa*ter", "*its molecules are too small*".

Finally, we have evaluated the pupils' comprehension of the dimensional scale from macro to micro world, finding that the correct replies given by experimental and control groups were not much different: the right replies on dimension order, from organism to atom were given by 61% of the pupils from the experimental and 71% from the control group. Many replies from one control class have been excluded because they had evidently been corrected after a check with the teacher.

BRAIN/MIND (questions 3, 4, 10, 8, 9, 11, 12)

Two learning objectives were present in many of the teaching modules of the project: understanding that the brain is involved in every function, action and sensation of the body; becoming aware of the higher functions of the brain and of how they shape our reactions to the environment, as well as the individual and collective behaviours.

The following parameters were then considered for the analyses of the pupils' replies:

- mentioning the brain among the body components involved in our actions and perceptions
- a correct functional attribution to nerve fibres
- the ability to differentiate mind states (intellectual and emotional)
- brain as the origin of mind states

The analysis showed that the great majority of the pupils of the experimental classes had learned that the brain is a necessary

component of our actions, but that only a few of them are aware that sense organs are as much important. 43.5% of the replies in the experimental *vs.* 17.7% in the control group state that nerve fibres transport signals from the brain to the periphery (organs) and vice versa. Smaller are the differences between the two groups concerning the ability to mention and differentiate mental functions: 50% of the replies from the experimental group name mind activities (*vs.* 44.4% of the control) and these are not simply centred on "thinking" but highlight a range of them: remembering, reasoning, controlling, taking decisions, dreaming, getting aware of danger, etc. The control group appears quite able to write about emotional states: 68.8% *vs.* 57.1% mentions at least three different emotions, and both groups acknowledge brain/hemispheres/mind as sites of them. Heart is mentioned in 2 replies in each group. "*Fear in the brain and love in the heart*" is another unique reply. The majority of pupils in both groups neglects to explicit how they become aware of their own emotions, only writing about how they recognize the emotions of other people from external signs, such as behaviour, eyes, voice.

HEALTH (questions 17, 18)

All the previous questions addressed topics that are included in the national school programs as well (i.e., environment, human body, matter) and, thus, are usually taught in each class. The last two questions of the questionnaire were more focused on the major aims of the SCIESA project: the promotion of health as well-being.

Question 17 was aimed to check how the concept of health/well-being had been acquired by the pupils; it probed which factors they acknowledge as relevant for being healthy. The narrative or the drawing of an episode in which they actively operated for being well or "*for making someone else be well"* was also suggested as an alternative way for illustrating the reply.

We have recorded the occurrence of the following categories of factors in the replies:

1. physical activity/sensations (positive or negative signals from the body)
2. correct diet
3. healthy life styles, hygiene, medical care

4. environmental qualities
5. social relations
6. personal situations, emotions.

Unfortunately, 12 out of the 46 pupils in the experimental group did not reply to Question 17.
32% in the experimental group (*vs.* 67% in control) listed more than one category, or even more than one factor within the same category. The factors included in category 1 (e.g., *practicing a sport activity, hiking, feeling well, feeling in good shape, having no ailment*) are the most commonly mentioned ones by the control group (51.1%) (*vs.* 29.4% in the experimental group). These are followed by category 2 (*eating healthy food, eating the right amount of food*) and category 5 factors. The latter are instead privileged by the pupils in the experimental classes: 47.0% of the listed variables belong to such category, which also forms the focus of the added, short narratives or drawings. These illustrate situations in which wellness is connected to sound social behaviours, such as: *not concealing lies, making friends to laugh, avoiding to quarrel with friends, being close or helpful to them, offering advice, offering friendship, making peace between people*. Emotional states or situations are also very frequently mentioned as health-promoting variables: *being happy, being the winner, playing, relaxing, having fun, not having evil thoughts, remembering funny things when sad, thinking of a well-being situation, listening to the music*.
24.4% of the factors mentioned in the replies from the control group belong to Category 3, Healthy life styles: *washing oneself, drinking more water during hot days, not watching TV all day long, keeping the back upright, avoiding unhealthy food, eating food containing calcium for the bones health, advising to avoid smoking*. Such factors are named in 11.7% only of the replies from the experimental group. Environmental variables (e.g., *spending time outdoor, breathing clean air*) are rarely mentioned by either group.

Question 18 asks the pupils to list words they associate with the idea of *feeling well*. Such kind of request was conceived by the researchers to deliberately avoid bookish or teacher's influences, and

to find out which words/meanings the pupils would freely associate with *health/well-being*.
The following semantic areas were identified in the lists of words written by the pupils:

- life styles / needs for being healthy
- physical training, sports activities, playing
- socialization
- feelings / emotions
- ethics / correct personal behaviours or qualities
- knowledge
- rest / quietness
- natural environments
- environmental qualities
- sources of pleasure

The analysis of the associations partially confirms the information drawn from the previous question. A greater average number of words (4.6) is listed by pupils in the experimental than in the control group (3.6). In the latter group, the words are highly centred in the area that describes life styles (28.0% *vs.* 15.4% in the experimental group) and physical activity (18.3% *vs.* 6.6%), whilst the words listed by the experimental group are more distributed among the different areas.

The most significant differences between the two groups concern three areas: *socialization, ethics* and *sources of pleasure*. As shown in Table 1, 15.4/% of the words mentioned by the experimental group, *vs.* 6.7% by the control group, are associated with the area of social relationships; 12.6% *vs.* 7.31% are associated with positive, even ideal social behaviours. Quoting some of the words: *peace, freedom, trust, respect, respect for the environment, facing one's own fears, love, not being angry, not spoiling your own life, loyalty, stability*. We would like to quote some of the associations with *sources of pleasure*, as they are not so obvious: *nutella, sponge cake, birthday, shopping, songs, technological objects, mint candies, adventure, no home-works, bathing*. Natural environments (e.g., *mountain, sea, natural parks, woods, plants, grass, animals*) appear

more frequently in the lists of the control (9%) than the experimental group (5.5%).

An interesting finding should be highlighted: in either groups the pupils do not associate well-being with family or parents. Possibly, these relatives are perceived as a safe base not necessarily to be mentioned. Altogether absent from the lists are also words belonging to the health or medical areas, as a source of health recovering (medical treatments, doctors, hospitals).

In conclusion, pupils in the experimental group display a better performance when the request is not a traditional notions-loaded task. They are in fact more fluent in producing associations with the idea of well-being than the pupils in the control group. In addition, a qualitative difference was found in the mentioned words, featuring variety and originality. The associations produced by the control group appear more obvious and predictable, being mainly focused on healthy diet and fitness and less sensitive to environmental factors, including the social ones that are considered to contribute to well-being. Pupils of the SCIESA project have developed a more comprehensive and articulated concept of health: in addition to food quality and physical activities they consider peace, freedom, love, friendship as things that make our life pleasurable. The design of the whole SCIESA project was oriented by this thoughtful conception of health, viewed as a process integrated within everyday life's environments rather than as a normative state, in agreement with the present definition of health by WHO, more complex than previously stated. Health is no longer simply identified with absence of illness but as a research of a functional, physical and psychical equilibrium that the individuals dynamically achieve in natural and social environments.

Question 17 HEALTH / WELL-BEING

	control classes	*experimental classes*
No answers	0	12
Answers	45	34
No. of pupils that list more than one factor	30	11
health/practicing sports, body sensations	23	10
health /a correct diet	19	9
health /sleep, personal hygiene, healthy behaviours	11	4
health /environment	9	2
health / social aspects	14	16
health /personal situations, emotions	9	10

Question 18 FEELING WELL (number and type of answers associated with *feeling well)*

	control classes	*experimental classes*
Total answers	45	39
Life styles / Needs for being healthy	46	28
Feelings / Emotions	26	28
Socialization	11	28
Sources of pleasure	2	23
Physical training, playing	30	12
Natural environments	9	17
Knowledge	3	4
Rest / Quietness	15	12
Ethics / Correct personal behaviours or qualities	12	23
Environmental qualities	9	6
	164	182

2. Sentences to be discussed

At the end of the class work on Module 11 a list of sentences was proposed to the three experimental classes. The sentences had been taken from the book "*Prevention in Adolescence*" by S. Bonino and E. Cattelino, Erickson, 2008, some of them modified to be suitable for the pupils' age.

The sentences were featuring various situations in the social environment in which the pupils might become involved, such as bullying, violent behavior, lack of respect for the environment and for others, the acceptance in a group, disobedience or even the transgression of social rules. The pupils were asked to express agreement or disagreement with each statement, and to state the reasons for their choice. Aim of the test was to evaluate *the arguing ability* of the pupils in supporting their positions. Since there was no control group, a comparison was made between the three classes of the experimental group. The pupils were initially given the full list of 16 sentences on which they had to simply mark their agreement/ disagreement. Then, only one of the 16 sentence was given to each pupil, with the request to explain the reasons for the agreement or disagreement. Care was taken to provide the same sentence to at least three pupils, so that we would be able to compare multiple answers. A brief discussion followed the reading of each topic. Only the sentences that have produced answers with a wide disparity of opinions will be illustrated here.

When they attend the secondary school (11 to 13 years old pupils) both girls and boys become aggressive.

Fifteen pupils in one of the classes and 7 the other agree with the statement.

Arguments to support the agreement:

- *when the primary school ends, friends are left behind. At the secondary schools bullying begins and one becomes more susceptible;*
- *it is not that when you go to the secondary school you become aggressive, it depends on what kind of person you are;*
- *because they already feel adults.*

Arguments to support the disagreement:

- *they usually should not be aggressive, because they should follow the behavior they have been taught in the primary school;*
- *if anything, this happens in the early years of the high school, but not even so much;*
- *you can as well be kind in secondary school;*
- *because people does not become aggressive all of sudden: if a person becomes aggressive then it means that he has always been so, even if he has never shown it before, and that only now he feels comfortable to show his aggressiveness in public. In addition, a person may become aggressive for a specific reason. It is precisely for this reason that I want to make it clear that in each person there is a bit of aggressiveness , but also that each person needs a good reason to become aggressive.*

It is quite normal for a boy to become aggressive, when he's angry

Broad agreement in two classes, much less in the third.

Arguments to support the agreement:

- *because when a boy is angry he needs to give vent to his anger and thus he becomes aggressive*
- *because people must get angry, and if they are very angry they can become aggressive*

Arguments to support the disagreement:

- *it is not normal*
- *some guys lose their calm, when they get angry*
- *because when one gets angry, he should not be aggressive, but should try to hold himself back and not to bother other people*
- *because a mature boy should be able to keep his temper and not to vent against others. A mature boy does not vent his anger, but talks to the other people.*

Isolating a classmate and speaking ill of him / her does not mean being aggressive.

In two classes half of the pupils agree, in the third only one out of 16 one agrees.

Arguments to support the agreement:

- *but it is nasty speaking ill of a classmate, even worse if he is isolated*
- *I agree in part, as speaking ill does not mean aggression, but I also do not agree, because it is unfair to speak ill*
- *because, excuse me, being aggressive means for example to punch, to bite, while speaking ill of somebody only means to isolate him*
- *because the meaning of isolating and being aggressive is different.*

Arguments to support the disagreement*:*

- *because speaking ill of a classmate is a mental aggression, since you show your classmate that you are speaking ill of him even if you do not tell him in the face*
- *because aggression needs not to be necessarily physical, may as well be psychological*
- *because it is a form of violence anyhow*.

Sometimes it happens that a forbidden action has to be performed in order to be accepted by the *group*

In each of the three classes, nearly a half of the pupils agree with the statement.

Arguments to support the agreement:

- because your mates want to see if you have the guts to do it
- people sometimes accept to do things that should not be done just to be accepted by a group
- ok, but I would never do it
- I am aware that this happens, but it should not
- if a group of classmates smokes or takes drugs and a classmate does not, the latter feels excluded and reacts by starting smoking, or it happens that the group speaks ill of him and so he starts smoking or taking drugs

Arguments to support the disagreement:

- because if you do something forbidden, maybe the group makes fun of you and won't let you join them, while people who saw you will consider you unpleasant and bully
- because everyone is responsible for his own choices
- because doing vandalism or violence is not nice and I think that it is better to leave the group than remaining doing wrong things
- because it does not mean that, to enter a stupid group, it is worth doing wrong things, like ruining other people's cars or neighbours' gardens.

The presence of "counter-current" or ambiguous answers (or both) should be noted, which suggests pupils' awareness that things are more complex than a black/white distinction.

From reading the collected materials it is evident that the pupils of all three classes do not hesitate to express personal and nonconformist opinions that, in most cases, they know how to argument. In addition they seem to have acquired the ability to deal with those everyday life situations that will force them to make choices. In this test, the environmental influences as well as those from family and socio-cultural models, are more evident than those coming from the teaching Modules. This is shown by the greater homogeneity present within the two classes of the branch of via Novara, as compared to the class of via Asmara in which family and socio-cultural models were more numerous.

c) Evaluations and comments on the SCIESA project by the pupils' parents, collected through a questionnaire

At the end of the school year a short questionnaire was prepared for the parents (*see below*) and given to them through their pupils. The questionnaire was aimed to obtain a feedback on the following points: how parents were being informed about the SCIESA project and what was the main source, which was their attitude and that of the pupils towards the project and how they evaluated it, their critical observations and possible proposals.

54% of the questionnaires were completed and given back; it should be noted that, unlike the branch of via Novara, almost all the parents

of the class of via Asmara replied to the questionnaire. All parents state that they had received information from their kids, teachers and school were minor sources, as were the meetings with the project's researchers. 10 out of 12 parents in one of the two classes of via Novara, write that they have participated in at least some of these meetings. 71% of the parents says that their pupils had shown a *highly favourable* attitude toward the project and 29% *quite favourable*. 82% considers the project as *very useful* and 75% believes that *it should be part of the core curriculum*.

Of some interest are the free comments added to the questionnaire, that are reported in full:

Sometimes pupils appear a little upset by seeing animal body organs such as the heart, the brain, a paw etc. Maybe too young? or not well prepared?

More communications with parents are needed on the specific topics of the modules through short explanatory documents.

More information, albeit in a synthetic way of what the pupils do in the classroom (summary sheets?).

Useful would be to improve the families involvement: pupils do not always tell. Active cooperation would be a useful support, an opportunity for parents and pupils to grow together.

My son is now more heedful to what he eats. He always asks me to do an experiment with him.

Useful a group activity on addictions (screen, internet, cellphone) possibly using these same tools to carry out statistical investigations on the abuse of technology.

A better integration of the indications coming from the different modules, even at different times of the school day (canteen, motor activities).

Project extension to the secondary school. To give continuity, perhaps involving the kids in periodic extra-curricular activities (e.g. risk factors), following a channel of dialogue that is already open.

Planning training days shared with parents with respect to the major project aims of the year.

The model works well as it is; ..., the best among those carried out by my son.

Overall, it can be concluded that, unlike what it was initially expected, organizing a systematic interaction with parents to facilitate their sharing of the objectives and educational actions was a difficult, partially unaccomplished, task, due to a variety of obstacles. Nonetheless the families have very positively welcomed the project, showing real interest in being informed about the ongoing activities and a wish to be more involved. However, a variety of obstacles makes it difficult an adequate parents participation to the project. It appears well evident a significant demand for continuity of educational interventions between school levels, with special regard to interventions that invest in the formation of pupils personalities. A significant demand for continuity of the specific educational interventions after primary school appears well evident, with special reference to those interventions considered more promising for the formation of pupils personalities.

d) Evaluations and comments by the teachers

All the Module 10 activities of have been satisfactorily accomplished. The work carried out during the past school year – the experiences at school with the microscope, the visit to an exhibit on DNA followed by readings on the school textbook – certainly facilitated the comprehension of the Science topics treated in fifth grade class, included in the national curriculum.

Module 11 has been too hurriedly carried out in class because of shortage of time, also considering the complexity and sensitiveness of its topics (accidental and infective risks, alimentary dysregulation, addictions). Nonetheless, environmental risks and types of addiction have been considered and extensively discussed with the support of the videos suggested in the list of teaching support materials. Some of the pupils in one class (5^{th} C) made an in-depth study about addiction to prepare a presentation for the parents. This highlights that pupils curiosity, when appropriately addressed may help them going beyond a superficial study and foster an effective learning.

The SCIESA project activities have encouraged teachers to exchange ideas and to collaborate, specifically when designing and evaluating

class activities. It has offered the opportunity to reflect on the everyday class practice, on the hands-on pedagogical methods that indeed was already featuring our teaching approach.
The SCIESA project has privileged the inductive teaching/learning strategies that aim to develop pupils' awareness and mastering of what they learn. Pupils become active learners, interpreters of their experiences. In sum, they "learn how to learn" through the inquisitive and critical attitudes that they acquire mainly through hands on work. The teaching proposals included in the Modules raised enthusiasm and stimulated cooperative learning that facilitated the participation of every pupil and the development of individual potentials.
The introduction in first grade class of topics that are generally considered too difficult for the young age of the pupils has been considered a success by the teachers. In their experience the project has shown that there are not hard topics when the teaching strategy is adequate and pupils enjoy their learning experiences: some of these have remained well impressed in the mind even in fifth graders. The teachers, that have just began a new primary school cycle, are continuing to apply these science teaching strategies and are using the teaching resources of the SCIESA project. For example, they are proposing to first graders observations with the stereomicroscope, "*in other words, our teaching practice has somewhat changed*".

The project activities have not taken time from the other curricular matters, rather, they have rather widened the pupils' learning interest in all the disciplines and have promoted an inductive approach in their studying practice. The activities were also a very helpful support to the writing practice: pupils were motivated to write a variety of texts from descriptions and summaries to scientific reports.

"*We think that the project is worthy, and deserving a wider diffusion in the Italian schools. A report on the experimental work that was carried out is therefore necessary, and this requires the previous elaboration of a working plan based on the elaboration of the documents prepared along the five years of the project. We felt as a shortcoming the lack of a science laboratory, a place where having*

the possibility to operate empirically and to share ideas while experimenting is feasible".

e) The pupils present the *Tree of life* to their parents

A meeting with the pupils' parents was organized, at the end of the school year, to give the pupils the opportunity of presenting a synthesis of the topics and activities developed during their school work, including the conclusive module of the SCIESA Project (*Risk factors and protection of the organism and the environment*). A large poster with the *Tree of life* was used to illustrate the risks for health and the resources everybody can mobilize for avoiding them thus "making the tree of life to bloom". The event was actually a festival, largely participated by the families and it was lived with deep emotion by the pupils, who were happy to show what they had accomplished and learnt. The presentations had been obviously prepared with the supervision of the teachers, who lived this situation as a sort of evaluation of their teaching, too. The experts were present and were positively impressed by the performance of the pupils: even considering some undue intervention of the teachers on the pupils' presentation, the core-message of SCIESA project seemed to be received!

Our observations in the classes and the findings from the collected protocols may allow to conclude that risk factors and the skills necessary to face them (the main topics of Module 11) can be profitably treated at the end of the first school cycle and that the information and evidence provided by watching videos, commented on and discussed together, are effective. In addition, we believe that the process of conceptualization concerning the organism, acquired during the previous teaching years, is a prerequisite to obtain this outcome.

Pre-adolescent pupils more freely talk about their experiences and come out with theirs and other people emotions. Moreover, at this stage of development they are less easily influenced by the attractive "models of success" appearing within the group of peers. The free attitude of the pupils in our experimental classes also reflects the climate of confidence that has been growing within the SCIESA

project participants over the years. It has connected pupils, teachers, parents and experts, joined by the common interest in experimenting and sharing this new experience, in improving their comprehension and, most of all, in a willingness to listen and pay attention to one another.

Questionnaire

1 – What makes an environment to be perceived as pleasant or unpleasant?

List in two groups the components that in your opinion feature the environment as pleasant or unpleasant

2 – We name as "environments" places such as rooms, towns, woods, but any environment is also the result of the interactions among the many components that characterize the place.

Select an environment that is familiar to you and try:

- to make a list of its components
- to describe the interactions occurring among them

3 – -Which parts of your body do work when you accurately launch a ball to a playmate?

4 – Which parts of your body are working when you are walking (legs apart)?

5 – What happens to the ingested food when inside our body?

6 – Describe the travel of the oxygen present in the air we breathe in.

7 –The blood pushed by the heart reaches the organs of the body. Which is its further journey? Where does it end up to?

8 – Make a list of the brain functions.

9 – The nerve fibers carry the signals:

from the centre (brain) to the periphery (organs) YES NO

from the periphery to the centre. YES NO

10 –Which sense organs may be stimulated when we walk around in a park where flowers are blooming? Make a list of the signals and explain where they are getting at.

11 –Which emotions do you know? Where they come from?

12 – How do we become aware of our emotions or of the emotions of someone else?

13 – Each one of us is connected through a "web" in the environment where one lives, not only through the cell phone or the internet web. Every living being is interconnected in a web that we cannot see but that we can imagine. Which environmental components do you feel in connection to? What does circulate in the web? Which parts of the body enable us to be "in the environmental web"?

14 – Put in order of size the following objects (from the bigger to the smaller one). You can write number 1 for the bigger and 5 for the smaller.

Organism ☐ Molecule ☐ Organ ☐ Atom ☐ Cell ☐,

15 – We can see and touch the sugar when it is inside a bowl, but when it is dissolved in water we can no longer see it. We know that it has not disappeared, because the water is sweet. What's then happened to that white matter that beforehand was visible? The sugar has dissolved into the water but what does actually happen that is invisible to us?

16 – When we eat more than we need our stores of energy grow too much. Which are the problematic consequences for our organism? Is there anything we can do for burning these surplus of energy stores?

17 – Explain in your own words the concept of health/well-being. You may describe or draw a situation when you did something for feeling well or for making someone else feel well.

18 – Write down all the words that come to your mind when you think to "feeling-well".