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Project Acronym: PAFSE

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EDUCATIONAL SCENARIO

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1. Specifications for an educational scenario on the topic of " Sustainable Mobility"

Context

There has been a crescent interest in the environmental crisis in the last decades, and the concept of "sustainability" has become the keystone and the reason for the development of environmental education, increasing its relevance in changing individual behavior. Not only has "sustainability" gained attention, but mobility has also become a crucial issue for people. The goal should conciliate both concepts, delivering mobility with minimal effect on human health and the environment.

The development of transportation and with it mobility in the last century became an essential factor in the globalization of modern civilization. Today we are more mobile than we have ever been, the success of a particular society is also reflected in its mobility. The more mobile it is, the more a society is economically developed and prosperous. However, the development of mobility has also had its dark side. Humans in the 20th century changed the world's ecosystem more than ever, and the consequences are global. Virtually all economic and other activities have had an impact on the environment and nature, though mobility has been particularly significant since it is embedded in practically all human activities. Today transport produces around a third of emissions which causes an increase in the greenhouse effect.

One of the major challenges of the 21st century is how to make global transport systems sustainable. The development of technology is an important element of this transition, though we believe that education on the importance of sustainable mobility is no less an important element, since it bolsters demand for the development of sustainable (unfortunately sometimes still referred to as alternative) forms of transport. We are aware that only long-term and systematic education about the benefits of sustainable mobility compared to conventional transportation can lead to a shift in people's mindset that will cause a shift in behaviour, understanding,, and actions. This scenario hopes to support the efforts to shift the pattern of mobility towards greater sustainability.

The SDGs of the United Nations (UN, 2015), "Rethinking Environment "and thus an ecological transformation of society presupposes Education for Sustainable Development (ESD) at schools. Schools focus mainly on traditional road safety education, rarely approaching the field of mobility and related concerns. It is of utmost importance to have a more comprehensive mobility education – with a look at human-environment interactions and one's behavior.

Children and young people are the most affected by the negative impacts associated with traffic. Lack of active mobility choices and a high rate of traffic accidents result in an unsafe road environment for school children. If we want children to continue to live well in a society where traffic plays a vital role, it is of prime importance that adults, in particular those in direct contact with children, are aware of their prominent mobility behavior.

Sustainable mobility in schools aims to promote the health of students through their movement, reduce the presence of cars in front of schools, and promote sociality and autonomy. Promoting more sustainable mobility patterns for young people, trying to focus on the importance of designing and reorganizing daily routes from home to school. The main objective is to improve air quality and reduce pollution, reducing health risks for citizens, especially the youngest, who are among the most at risk.

Therefore, this scenario wants not only to contribute to how an educational concept for schools in sustainable mobility needs to be designed to initiate and change students' ways of thinking and acting but also to show that pedagogical activities need to be oriented toward sustainable mobility as a tool to guarantee a better future for younger generations.

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Scientific content and its relevance to public health education

One of the biggest environmental challenges we face today is mobility. Transportation still accounts for 24% of direct CO2 emissions from fuel burning, according to the International Energy Agency (IEA). Road vehicles account for almost three-quarters of CO2 emissions and those from aviation and maritime transport continue to increase. The way we travel impacts economic sustainability, the social cohesion of cities and, of course, air quality. Sustainable mobility advocates a form of locomotion that does not harm the environment through polluting emissions and meets the needs of citizens while taking care of the city's spaces. Sustainable mobility contributes mainly to six of the 17 United Nations Sustainable Development Goals: SDG 8, 9, 11, 12 and 13. In this context, this learning scenario contributes to the reflection, awareness, and alteration of behaviours and attitudes in order to promote sustainable and safe mobility of road users.

Subject: Physical-Chemical Classes and Citizenship and Development Classes.
Grade: 7th grade (+/- 12-13 years old students) - 8th year (13-14 years-old students)
Title of educational scenario: Sustainable Mobility.

Estimated duration

6 sessions of 40-45 minutes (lesson 1 – lesson 6)
6 sessions of 40-45 minutes for supplementary learning activities and school project (lesson 7 – lesson 12)

Classroom organization requirements

From session 1 to session 6, students work essentially in groups, in pairs and individually, with the teacher's coordination.

It's required, a typical classroom with tables, chairs for students and equipped with:

- tablets/laptops with internet access for students to do research, explore teaching resources and carry out activities;
- a support table to place material;
- a laptop, video projector and speakers, Wi-Fi internet access to view and explore teaching resources (powerpoint presentations, videos, animations, activities);
- whiteboard or flipchart and respective markers of different colors and erasers, to register key ideas, collect opinions and discuss ideas; ask questions, write down information from students in the face of challenges.

To carry out the research project, about 6 classes are needed. Students work in groups of 4 or 5 elements. It is necessary to have a computer/tablet with internet access to answer the questionnaire on mobility patterns and data processing, as well as to create infographics/posters about school mobility patterns and suggestions for measures to be taken.

Content glossary

Accessibility. The accessibility of an activity for a person is the ease with which the person can get to places where that activity (e.g. education, work, leisure) takes place. The term accessibility therefore refers to the ability to reach activities and not movement itself using different modes of transport.

Air pollution. The presence of contaminant or pollutant substances in the air at a concentration that interferes with human health or welfare, or produces other harmful environmental effects.

Alternative energy. Energy that does not come from fossil fuels.

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Bicycle. A road vehicle which has two or more wheels and generally propelled by the muscular energy of the persons on that vehicle, in particular by means of a pedal system, lever or handle (e.g. bicycles, tricycles, quadricycles and invalid carriages).

Bike Sharing. Service for sharing a fleet of bicycles through a rental or loan system for a certain period.

Car. Vehicle with a propulsion engine, equipped with at least four wheels, with a tare weight greater than 550 kg, whose maximum speed is, by design, greater than 25 km/hour, and which is intended, due to its function, to travel on public roads, without being subject to rails.

Carbon dioxide. Gas naturally produced by animals during respiration and through decay of biomass, and used by plants during photosynthesis. Although it only constitutes 0.04 percent of the atmosphere, it is one of the most important greenhouse gases. The combustion of fossil fuels is increasing carbon dioxide concentrations in the atmosphere, which is believed to be contributing to global warming.

Carbon footprint. Measures CO2 emissions associated with fossil fuel use.

Carpooling. An initiative in which two or more people share a private car to make the same or part of a similar route, including the sharing of fuel and toll costs, allowing to save money, improve the environment and even meet people.

Carsharing. Model for making vehicles available for public use, allowing the same vehicle to be used by different customers throughout the day, thus avoiding the expenses associated with the acquisition and maintenance of vehicles. Pickup and delivery of vehicles are carried out at different locations (preferably strategically located).

Climate change. A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Coal. The natural, rocklike, brown to black derivative of forest-type plant material, usually accumulated in peat beds and progressively compressed and indurated until it is finally altered in to graphite-like material.

Cube corner retroreflection. This technology returns light more efficiently than glass beads. With this technology, each cube corner has three carefully angled reflective surfaces. Incoming light bounces off all three surfaces and returns to its source.

Cycle track. Independent road or part of a road designated for use by cyclists and sign-posted as such. A cycle track is separated from other roads or other parts of the same road by structural means.

Decibel. A logarithmic scale used to denote the intensity, or pressure level, of a sound relative to the threshold of human hearing. A step of 10 dB is a 10-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.

Diffuse reflection. The reflection of light from a surface such that an incident ray is reflected at many angles, rather than at just one angle.

Driver. A person who controls a vehicle or animal on a public road.

Ecological Footprint. The impact of human activities measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated. More simply, it is the amount of the environment necessary to produce the goods and services necessary to support a particular lifestyle.

Energy. Measure of a System's ability to interact, it is present in all phenomena that occur in nature, it can be transferred or converted from one form to another, but it is never created or destroyed.

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Energy efficiency. Refers to actions to save fuels by better building design, the modification of production processes, better selection of road vehicles and transport policies, the adoption of district heating schemes in conjunction with electrical power generation, and the use of domestic insulation and double glazing in homes.

Energy Footprint. It is an indicator that allows us to assess the amount of energy we use in all our daily activities.

Energy recovery. A form of resource recovery in which the organic fraction of waste is converted to some form of usable energy. Recovery may be achieved through the combustion of processed or raw refuse to produce steam through the pyrolysis of refuse to produce oil or gas; and through the anaerobic digestion of organic wastes to produce methane gas.

Energy saving. Avoiding wasting energy.

Environmental Citizenship. The exercise of good practices and public, individual and collective participation in environmental and sustainable development issues, through the design and development of information and communication strategies, as well as education and training, using the channels and means considered most appropriate, taking into account the requirements of the information society and lifelong learning.

Environmental Ethics. Ability to reflect on the value we attribute or should attribute to the environment and on the values that guide or should guide our relations with the environment.

Environmental health. Aspects of human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health. Environmental health includes both the direct pathological effects of chemicals, radiation and some biological agents, and the effects (often indirect) on health and well-being of the broad physical, psychological, social and aesthetic environment, which includes housing, urban development, land use and transport.

Environmental impact. Impacts on human beings, ecosystems and man-made capital resulting from changes in environmental quality related, since it is nearly impossible to produce, transport, or consume energy without significant environmental impact. The environmental problems directly related to energy production and consumption include air pollution, climate change, water pollution, thermal pollution, and solid waste disposal.

Environmental noise. Unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity such as those defined in Annex I to Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control.

Environmental risk. Likelihood, or probability, of injury, disease, or death resulting from exposure to a potential environmental hazard.

Equality. The right for all human beings to be equal in dignity, to be treated with respect and consideration and to participate on an equal basis with others in any area of economic, social, political, cultural or civil life. All human beings are equal before the law and have the right to equal protection and benefit of the law.

Equity. Being fair and impartial, ensuring that everyone has access to the resources, opportunities, power and responsibility they need to reach their full, healthy potential – acknowledging that different people have different needs.

E-scooter. (Synonym: Standing Electric Scooter) A stand-up or seated scooter that can be propelled by the electric motor itself, irrespective of the user kicking.

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Ethics. Moral principles by which an individual governs his personal or professional conduct.

Excessive Speed. Speed that, taking into account the characteristics and condition of the road and the vehicle, the load carried, the weather or environmental conditions, the intensity of traffic and any other relevant circumstances, does not allow, in safety conditions, to carry out the maneuvers whose need to anticipate and, in particular, stop the vehicle in the clear and visible space in front of it.

Fossil fuel. Any of a class of hydrocarbon-containing materials of biological origin occurring within Earth's crust that can be used as a source of energy.

Glass-bead retroreflection. An incoming light beam bends as it passes through a glass bead, reflects off a mirrored surface behind the bead, then the light bends again as it passes back through the bead and returns to the light source.

Global Warming. Increase in Earth's temperature caused by the increase in greenhouse gas emissions that has been occurring since the mid-19th century.

Greenhouse effect. Warming of the atmosphere due to the reduction in outgoing solar radiation resulting from concentrations of gases such as carbon dioxide.

Greenhouse gas. Gas that contributes to the natural greenhouse effect. The Kyoto Protocol covers a basket of six greenhouse gases (GHGs) produced by human activities: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Annex I Parties' emissions of these gases taken together are to be measured in terms of carbon dioxide equivalents on the basis of the gases' global warming potential. An important natural GHG that is not covered by the protocol is water vapour.

Hazard. Any potential source of harm, injury or adverse health effect to a person, or damage to something; an object, process or condition that may expose a person to risk of harm or injury. Driving-related hazards include practices (e.g. speeding, following too close, not wearing seatbelt, overloading vehicle, insufficient driver training), conditions (fatigue, slippery roads), objects (loose wheel nut), substances (carbon monoxide, alcohol), materials (gravel surface) and energy (from your vehicle, or an oncoming vehicle).

Human health. The avoidance of disease and injury and the promotion of normalcy through efficient use of the environment, a properly functioning society, and an inner sense of wellbeing.

Intergenerational Responsibility. Ability of each generation to care for the cultural and natural heritage received from previous generations and keep it for future generations.

Law of reflection. If a ray of light could be observed approaching and reflecting off of a flat mirror, then the behavior of the light as it reflects would follow a predictable *law.*

Lifestyle. A way of living based on identifiable patterns of behaviour which are determined by the interplay between an individual's personal characteristics, social interactions, and socio-economic and environmental living conditions.

Micromobility. Personal transportation using devices and vehicles weighing up to 350 kg and whose power supply, if any, is gradually reduced and cut off at a given speed limit which is no higher than 45 km/h.

Mitigation (climate change). Human intervention aimed at reducing sources or increasing sinks of greenhouse gases.

Mobility. Ability to reach a place, which is enhanced by accessibility, which is the ease by which a place can be reached.

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Moped. Vehicle equipped with two or three wheels, with a maximum speed, on a level and by construction, not exceeding 45 km/h, and whose engine has a cylinder capacity not exceeding 50 cm^3 or whose maximum power does not exceed 4 kW.

Mortality. The death rate; the ratio of the number of deaths per year to a given population.

Multimodal transport. Integration of various modes of transport such as walking, cycling, private car, public transport and railway into transport planning. It seeks to promote complementarity and interconnection among these modes to ensure a seamless flow of people and goods from one place to another.

Noise. Consists of all unwanted sound; sound that is loud, unpleasant or unexpected.

Noise level. Physical quantity of sound measured, usually expressed in decibels.

Noise pollution. Harmful or unwanted sounds in the environment, which in specific locals, can be measured and averaged over a period of time.

Non-renewable energy sources. Sources that are found in nature in limited quantities and whose reserves are depleted, as their formation process is very slow when compared to their rate of consumption by human beings.

Ozone. Triatomic form of oxygen (O3), is a gaseous atmospheric constituent. In the troposphere - at ground level - it is created both naturally and by photochemical reactions involving gases resulting from human activities (photochemical smog).

Ozone hole. A sharp seasonal decrease in stratospheric ozone concentration that occurs over Antarctica in the spring. First detected in the late 1970s, the ozone hole continues to appear as a result of complex chemical reaction in the atmosphere that involves CFCs.

Passenger. A person carried by a vehicle on a public road and who is not a driver.

Passive safety. Any device that automatically provides protection for the occupant of a vehicle, such as safety-belts, motorcycle helmets, child restraints, padded dashboard, bumpers, laminated windshield, head restraints, collapsible steering columns and air bags.

Pedestrian. Person who transits on public roads and in places subject to road legislation on foot. Pedestrians are also, all persons who drive bicycles or two-wheeled mopeds by hand without a car towed, or cars for children or the physically handicapped.

Pedestrian Lane. Public road or transit lane specially designed for pedestrian traffic on foot.

Pollution prevention. The use of materials, processes, or practices to reduce, minimise, or eliminate the creation of pollutants or wastes. It includes practices that reduce the use of toxic or hazardous materials, energy, water, and/or other resources.

Prevention. Action taken to reduce known risks.

Prevention principle. This principle allows action to be taken to protect the environment at an early stage. It is now not only a question of repairing damages after they have occurred, but to prevent those damages occurring at all. This principle is not as far-reaching as the precautionary principle. It means in short terms: it is better to prevent than repair.

Public health. An organized activity of society to promote, protect, improve, and – when necessary – restore the health of individuals, specified groups, or the entire population. It is a combination of sciences, skills and values that function through collective societal activities and involve programmes, services and institutions aimed at protecting and improving the health of all people.

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Public space. The entire space-time area, in principle outside the buildings and with free access and use.

Public transport. Systems of transport consisting of services and routes that are used for travel by the general public as passengers as opposed to an individual. These group travel systems are also referred to as mass transit and high-capacity transit services in some countries.

Quality of life. The general well-being of a person or society, based on a range of criteria such as health and happiness, rather than only wealth.

Renewable Energy Sources. Energy sources such as the sun, wind, water, biomass, tides, geysers and fumaroles that are continually renewed in nature, not being possible establish a time limit for their use, and are therefore considered inexhaustible.

Retroreflection. When a surface returns a large portion of directed light beam back to its source.

Retroreflective materials. Appear brightest to observers nearest the light source (such as a motorist). The object's brightness depends on the intensity of the light striking the object and the materials the object is made of.

Risk Factors. Characteristics, situations, behaviors that can trigger the occurrence of an accident and/or potentiate its consequences. Among the main risk factors are excessive or inappropriate speed, driving under the influence of alcohol, cell phone use while driving, fatigue, distraction and the ingestion of medication and drugs.

Road. Line of communication (travelled way) open to public traffic, primarily for the use of road motor vehicles, using a stabilized base other than rails or air strips. Included are paved roads and other roads with a stabilized base.

Road accident. A break in the balance of the road system. When the demands of the road environment, in a given place, are greater than the user's response capabilities.

Road environment. Set of elements and external conditions that surround road users and influence them.

Road motor vehicle. A road vehicle fitted with an engine whence it derives its sole means of propulsion, which is normally used for carrying persons or goods or for drawing, on the road, vehicles used for the carriage of persons or goods.

Road safety. Any measure, technique or design intended to reduce the risk of harm posed by moving vehicles along a constructed land route.

Road space. Infrastructures that involve the road context – type of road and configuration, guides, walks, signage, surrounding constructions and location.

Road traffic. Circulation of motor vehicles and people on the road network.

Road user behaviour. Actions exhibited by people who travel on the road that either increase or reduce the risk of a road traffic collision occurring.

Roadway. Part of the public road especially intended for the circulation of vehicles.

School Mobility Plans. A planning tool that aims to achieve a more sustainable management of travel by the entire school community (students, parents, staff and teachers), through the implementation of practical solutions aimed at: changing travel habits, reducing dependence on the car in favor of pedestrians, bicycles or public transport; improve safety and quality of life at school access; and sensitize the school community to more sustainable mobility.

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Shared mobility. Shared use of a vehicle, motorcycle, scooter, bicycle, or other travel mode. Shared mobility provides users with short-term access to one of these modes of travel as they are needed.

Sidewalk. Part of the public road reserved for the circulation of pedestrians and which flanks the carriageway.

Social cost. The full cost including external cost imposed on society by a given activity.

Specular reflection. Reflection off of smooth surfaces such as mirrors or a calm body of water leads to a type of reflection.

Street. Includes a central aisle dedicated to longitudinal circulation (vehicles, bicycles), as well as sidewalks or side spaces, most often represented by shoulders.

Stress. A stimulus or succession of stimuli of such magnitude as to tend to disrupt the homeostasis of the organism.

Sustainability. Meeting the needs of the present without compromising the ability to meet future needs.

Sustainable Development Goals (SDGs). Also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The 17 SDGs are integrated—that is, they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability

Sustainable Mobility. A set of processes and actions aimed at the movement of people and goods, with a reasonable economic cost and at the same time minimizing the negative effects on the environment and on the quality of life of people, with a view to the principle of meeting current needs without compromising future generations.

Transport mode. The way in which passengers and/or goods can be transported.

Urban noise. Noise emitted from various sources in an urban environment.

Vehicle. (motor vehicle) Any power-driven vehicle which is normally used for carrying persons or goods by road or for drawing on the road, vehicles used for the carriage of persons or goods. This term embraces trolley buses, that is to say, vehicles connected to an electric conductor and not rail borne. It does not cover vehicles, such as agricultural tractors, which are only incidentally used for carrying persons or goods by road or for drawing, on the road, vehicles used for the carriage of persons or goods.

Vulnerable Road Users. (VRU) are defined in the European Union Intelligent Transport Systems Directive as "non-motorised road users, such as pedestrians and cyclists as well as motor-cyclists and persons with disabilities or reduced mobility and orientation".

Waste. Any substance or object that the holder discards or intends or is obliged to discard, namely those identified in the European Waste List.

Well-being. Well-being is a positive state experienced by individuals and societies. Similar to health, it is a resource for daily life and is determined by social, economic and environmental conditions.

Sources: **European Commission, European Environment Agency, General Direction of Education, Institute of Mobility and Transport, National Road Safety Authority, Portuguese Road Safety Association, The Urban Mobility Observatory.**

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Pedagogical glossary

Active Learning. A teaching and learning approach that "engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work.".

Brainstorming. An instructional technique with several variations, that might take place within small group or with the entire class. During brainstorming all students shortly express their ideas or concepts which are relevant to a given guiding question or central term. Criticism on the ideas is absent during brainstorming and its aim is the production of a lot and divergent ideas.

Collaborative Learning. An umbrella term that covers many different methods in which students work together to solve a problem, complete a task, or create a product. Collaborative learning is founded in the concept that learning and knowledge building is social and requires active engagement from students.

Critical Thinking. The mental processes used when evaluating information that has been put forth as true. Consists of reflection, examination, and formation of judgement. Information is gathered through communication, experience, reasoning and observation. While based in values of intellect, critical thinking goes beyond subject/matter division.

Cross Debate Technique. In this modality, each of the groups must defend a certain thesis, generally contrary to the other groups. The advantage of this technique is that participants need to hear opposing opinions, make them reflect on them and learn to compete in the field of ideas.

Debate Technique. A verbal technique used with the purpose of involving a group in a certain theme that will be exposed. This technique consists of dividing two or more subgroups in which each one participates in the discussion of a general theme and in the construction of a "general commitment" of all.

Engagement. How a student does or does not feel toward learning and his or her learning environment.

Group Work. Deepens knowledge, develops research and problem-solving skills; develops attitudes of participation, cooperation, creativity and collaboration; develops teamwork attitudes, social skills and knowledge.

Inclusive Teaching. A mode of teaching that intentionally designs course content and curricula to engage with students of diverse backgrounds, abilities, and lived experiences. The ultimate goal of inclusive teaching is to create a learning environment where all students feel valued and supported to succeed.

Information. Facts, ideas, concepts and data that have been recorded, analysed, and organized in a way that facilitates interpretation and subsequent action.

Inquiry based learning. By the term inquiry-based learning we refer to the engagement of students in learning activities during which they practice several scientific inquiry skills. Students make use of these skills in order to answer to scientific questions either posed by the students themselves or by the teacher, by the handling of authentic data, either experimentally collected by themselves or given already collected. Some common inquiry skills include constructing and using models, carrying out experiments, data collection and organisation, variable handling, data driven conclusion making and communicating over scientific issues.

Knowledge - a familiarity, awareness or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning.

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Lifelong learning. A broad concept where education that is flexible, diverse and available at different times and places is pursued throughout life. It takes place at all levels—formal, non-formal and informal—utilizing various modalities such as distance learning and conventional learning.

Pedagogical Techniques. Essential resources that the teacher uses to enhance the pedagogical relationship between the students and the teacher in order to ensure learning. Different forms of application to achieve the objectives of a class.

Project based learning. An instructional model of active learning. It has several forms, during which students work in groups on the development of projects, which often refer to authentic problems or situations approaching real life conditions. Project based learning includes the phases of project initiation, project development and project presentation.

Quiz. A form of student assessment, usually with fewer, less difficult questions than a test, and with less difficulty.

Research. The systematic process that looks to discover, interpret, and revise facts to produce a greater understanding of behaviors, events, and theories. It creates practical applications through theory and law. Research can also be used to describe information collected about a subject, most often associated with the scientific method.

Skill. The ability to carry out a task with pre-determined results often within a given amount of time, energy, or both. Skills can often be divided into domain general and domain-specific skills.

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Competences / Learning Goals

Key Competences
STEM / Personal, social and learning to learn, literacy, citizenship

Knowledge
Science concepts:
- Energy Sustainability.
- Fossil and renewable energy.
- Air pollution and noise.
- Climate change.

Social concepts and global concerns:
- Sustainable Mobility.
- Environmental protection and social and economic dimension.
- Climate change: the impact of the transport sector.
- Eco-mobility.
- Shared mobility.
- Integrated mobility.
- Active mobility.
- Public Health.
- Quality of life.
- Road Safety.
- Urban and Environmental Health.
- Lifestyles.
- Road risk.

Knowledge - outcome assessment:

1. Recognizes and characterizes patterns of Sustainable Mobility.
2. Identifies the principles of Sustainable Mobility and explains their relationship with the SDGs.
3. Recognizes the advantages and disadvantages of fossil and renewable energy and proposes general action to reduce air pollution and fight climate change.
4. Identifies the most important consequences of motorized transport in the environment, quality of life and road safety.
5. Identifies the best national and international practices that promote Sustainable Mobility.
6. Identifies relevant action to address challenges related with Sustainable Mobility at the community and societal level.
7. Recognizes relevant road risks for vulnerable road users and identifies appropriate actions to prevent or mitigate them.

Skills (abilities/competences)
General: Critical thinking, curiosity; data analysis and interpretation, risk assessment, public speaking and active debate/participation; social responsibility; respect and solidarity with others; problem-based learning; scientific and technical knowledge; teamwork; collaboration; argumentation; self-awareness, citizenship.

Specific:

- Finding, analyzing, and interpreting scientific data, texts, dynamic graphical representations and videos to map the principles of Sustainable Mobility.

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- Understanding the relevance of scientific evidence to explain phenomena related to environment, mobility, health and illness and produce argumentation.
- Obtaining, assessing, and communicating evidence concerning the impact of transport choices on environment, health, quality of life and road safety.
- Assessing risks and behaviours in traffic as well as patterns of sustainable mobility.
- Analyzing the impact of different transportation options in terms of air pollution and ecological footprint.
- Understanding appropriate strategies to reduce personal and community risk and getting access to the relevant resources.

Skills – outcome assessment:

1. Selects appropriate concepts, principles, and evidence to characterize Sustainable Mobility.
2. Can anticipate the consequences of different transport choices and users' behaviour in terms of Sustainable Mobility.
3. Can adopt sustainable mobility patterns to achieve a healthier and safer lifestyle (e.g., chooses a sustainable and safe transportation mode instead of an unsustainable and unsafe one).
4. Rejects unsafe traffic behaviours in the interactions with his/her peers.
5. Can propose concrete action towards adopting sustainable mobility patterns in his/her/others routine.
6. Feels able to influence the adoption of sustainable mobility patterns and safe traffic options by others (e.g., family, peers, friends).
7. Can identify the problems and challenges of the community in relation to Sustainable Mobility. connects them with SDGs and finds the relevant resources to address them.

Affective/Attitudes Behaviour (*beliefs)*

- Adopting safe behaviours in traffic as a pedestrian, cyclist, motorcyclist, moped rider, and/or as a passenger (car/bus).
- Adopting attitudes towards sustainable mobility.
- Adopting attitudes supporting health, sustainable development, urban and environmental health.
- Recognizes risks in traffic and adopts attitudes towards minimizing or mitigating them.
- Engaging public speaking and debating of measures to reduce risky behaviour in traffic, with a particular focus on public policy concerned with road safety and Sustainable Mobility.

Attitudes and behaviour - outcome assessment:

1. Believes that Sustainable Mobility is a fundamental component of health and quality of life.
2. Believes that is important to contribute to a more sustainable mobility
3. Believes that individual choices influence Sustainable Mobility and Sustainable Mobility influences health and quality of life.
4. Believes that is important to adopt sustainable mobility patterns to prevent climate change, to be healthy and safe.
5. Reproves patterns of risky, unhealthy and unsafe behaviour, as a vulnerable road user.
6. Adopts eco-friendly mobility patterns and believes that it contributes to healthier and safer lifestyles (e.g., Integrated mobility through transport offer; security; schedules; duration; traffic fluidity; cost; walking route).
7. Is committed to communicate and address the challenges of the community in relation to the determinants of Sustainable, Secure and Healthy Mobility, and to contribute to the SDGs.

Learning goals and outcomes

- Uses online tools to plot tables, graphs, and maps, using updated data.
- Describes the concept of sustainable mobility and recognizes its importance.
- Analyzes the consequences of motorised transport options, in environmental terms, energy dependency, economy, health, efficiency of the transport system, quality of life of cities and road safety.

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- Uses evidence to build argumentation that sustainable mobility requires the combination of changes in environmental, economic and social policies and humans' behaviour.
- Recognizes the need to use environmentally friendly technologies in mobility systems.
- Identifies solutions that promote sustainable mobility based on national and international best practices.
- Identifies road risk situations.
- Adopts appropriate and safe behaviours in traffic as a pedestrian, cyclist, driver of personal transportation vehicles, and public transport passenger.
- Recognizes that road citizenship is based on risk perception and respect for all road users.

Assessment methods

✓ Outcome assessment
  - Quantitative – questionnaire.
  - Qualitative - students project.

✓ Process assessment - *assessment of the teaching-learning sequence* – observation grid*:* reaching the target audience, and extent; implementation of the scenario as planned; run of the learning scenario as expected/organizational issues to be solved; duration of the teaching-learning sequence; number of people exposed; score for likeability – students ("how fun was it to do"/ how fun would be to do again/ how could it be better).

Content (relevant to learning goals & research topics)

STEM content
- Energy unit: joule (J) and calorie (cal).
- Fossil energy.
- Renewable energy: kW; MW.
- Environmental pollution and noise.
- Greenhouse gas emissions: carbon dioxide, sulphur dioxide, carbon monoxide, nitrogen oxides, lead.
- Noise scale - decibels (Db) and hertz frequency (Hz).
- Optical phenomenon – Retroreflection.
- Safe and appropriate measures/ behaviours for vulnerable road users.

Non-STEM content
- Quality of life - well-being.
- Active and soft modes of transportation (trends).
- Vulnerability of pedestrians and 2-wheel users.

Digital Learning Objects

- New
  - **New Digital Learning Object 1**: Greenhouse Effects (digital interactive quiz).
  - **New Digital Learning Object 2**: Vulnerable Road Users – Safe behaviours, Risks and Dangers
  - **New Digital Learning Object 3**: Optical phenomenon – Retroreflection - Simulator "Be seen"
  - **New Digital Learning Object 4**: Quality of Life & Road Safety (digital interactive quiz).

From other sources/high quality platforms:

- Environmental protection and social and economic dimension:
  - **Digital Learning Object 5**: indices - Air Quality Index | State of the Environment (apambiente.pt) and/or the APP - QUALAR
  - **Digital Learning Object 6:** Ecological footprint calculator

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- EcoMobility:
  - **Digital Learning Object 7**: Citymapper - The Ultimate Transport App and/or App Moovit

Digital Educational Resources

- New:
  - **New Digital Educational Resource 1**: Principles and pillars of sustainable mobility
  - **New Digital Educational Resource 2**: School Mobility Patterns
  - **New Digital Educational Resource 3**: Benefits and disadvantages of modes of transport and their impact on individual quality of life and public health.
  - **New Digital Educational Resource 4**: Retroreflective material: the importance of visibility - see and be seen
  - **New Digital Educational Resource 20**: Ecological footprint commitment layout
  - **New Digital Educational Resource 21**: Step by step on applying a questionnaire

From other sources/high quality platforms:

- Sustainable Mobility
  - **Digital Educational Resource 5**: What is Sustainable Mobility? - Video
  - **Digital Educational Resource 6**: Benefits of Sustainable Mobility - Infographic

- Energy Sustainability:
  - **Digital Educational Resource 7**: All solutions are needed: Fossil and renewable energy - Video
  - **Digital Educational Resource 8**: Natural resources – Video

- Environmental protection and social and economic dimension:
  - **Digital Educational Resource 9**: Noise pollution — European Environment Agency (europa.eu)
  - **Digital Educational Resource 10**: Noise Levels - Infographic
  - **Digital Educational Resource 11**: Air pollution: how it affects our health - Infographic

- EcoMobility:
  - **Digital Educational Resource 12**: Education for Sustainable Development Goals - UNESCO
  - **Digital Educational Resource 13**: Sustainable Transport, Sustainable Development - ONU
  - **Digital Educational Resource 14**: We have the power to move the world – best practices
  - **Digital Educational Resource 15**: How safe is walking and cycling in Europe

- Quality of Life and Road Safety:
  - **Digital Educational Resource 16**: Light Reflection
  - **Digital Educational Resource 17**: Reflective Material – 3M - Video
  - **Digital Educational Resource 18**: Crash Test Personal Transportation Vehicle/Truck
  - **Digital Educational Resource 19**: Crash Test Personal Transportation Vehicles/Pedestrian

Teaching -learning activities

Principal target:
Physics and Chemistry classes (12-14 years old students); Citizenship and Development classes (students 12-15 years old)
6 sessions/classes of 40-45 minutes
Chemistry, Physics and Sciences teachers integrate other colleagues in the enactment of the scenario (e.g., ICT, visual education, science and english teachers), as it aims to be interdisciplinary.

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Lesson 1: Sustainable mobility

- **Concept and principles of sustainable mobility.**

Students will be organized in groups of 4/5 people with the aim to answer the following questions:

- "What does sustainability mean?
- "What is sustainable mobility? Can you identify the underlining principles?"

Through a *brainstorming e*ach student gives their inputs while the group organizes the main ideas to present them to the class. In parallel, the teacher writes on the board, the main ideas of each group, distributing them in order to answer each question.

What does sustainability mean?
"Sustainability means meeting the needs of the present without compromising the ability to meet future needs."

➢ **Explore the animation – New Digital Educational Resource 1:** Principles and pillars of sustainable mobility

Using this animation that addresses the issue of sustainable mobility at various levels (health, environmental, economic) the teacher raises awareness on the need to choose sustainable modes of transportation. Students are guided through the benefits and disadvantages of different modes of transportation and think about the possibility of combining different ones in their routines.

As a way of cementing knowledge and defining the most complete concept of sustainable mobility and its principles, the following multimedia resource is presented to the students:

➢ **Watch the video - Digital Educational Resource 5:** What is Sustainable Mobility?

Definition of Sustainable Mobility: a set of processes and actions aimed at the movement of people and goods, with a reasonable economic cost and at the same time minimizing the negative effects on the environment and on the quality of life of people, with a view to the principle of meeting current needs without compromising future generations.

Principles of Sustainable Mobility: energy, economy, environment and quality of life.

- **Energy sustainability**

Energy resources: fossil and renewable energy sources - advantages and disadvantages.

➢ **Debate:** The class will be divided into 2 groups, the "fossil energy advocates" and the "renewable energies defenders", the teacher being the moderator and responsible of previously identified and differentiated the sources. With this debate students position themselves in the defense of advantages and disadvantages of the selected resources.

Example of debate topics:

✓ Renewable energy (advantages - a fuel supply that never runs out; zero carbon emissions; cleaner air and water; a cheaper form of electricity...);
✓ Fossil energy (disadvantages - Contribute to climate change, fossil fuels are the main driver of global warming; fossil fuels are non-renewable sources of energy; unsustainable, we are using too many fossil fuels too quickly; accident-prone.

At the end of this session, after analyzing the results of the debate, it should be concluded that environmental pollution has a direct impact on the health and quality of life of the populations.

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Lesson 2: Environmental protection and social and economic dimension

Environmental pollution and noise and their impact on health.
Understanding the impact of noise on health by exploring an infographic of noise levels of daily activities, from low audibility to pain limit.

- **Infographic – Digital Educational Resource 10: Noise Level Scale**

(Decibel scale - since low audibility - zero db; 120 dB - corresponds to the pain threshold and 200 dB corresponds to a nuclear explosion. And the minimum level to which a sound, with a frequency of 3000 Hz, can be heard).

Explanation and identification of sound levels (dB) and frequency - (Hz) - Students are asked to give examples of daily activities that can correspond to the noise levels presented in the infographic, from birds singing, to cars passing and plane landing.

- **Students are invited to search some examples of diseases that they think are related to noise and air pollution.**

Impact on health: it addresses the issue related to the health impact of different types of pollution - environmental and noise - the following infographics are analyzed and discussed:

- **Digital Educational Resource 11: Air pollution: how it affects our health**

Air pollution is a major cause of premature death and disease and is the single largest environmental health risk in Europe. Latest estimates by the European Environment Agency (EEA) show that fine particulate matter (PM2.5) continues to cause the most substantial health impacts.

- **Digital Educational Resource 9: Noise pollution — European Environment Agency (europa.eu)**

Noise pollution is a growing environmental concern. Noise disturbs sleep and makes it harder to learn in school. It can also cause or aggravate many health problems. The most important source of environmental noise in Europe is road traffic.

- ✓ **Air quality:**

Through an exploration method, the teacher presents and explains the impact of air quality in health, using the Portuguese Environment Agency website with analysis of air quality.

- **Digital Learning Object 6: indices - Air Quality Index | State of the Environment (apambiente.pt)** and/or the **APP - QUALAR** that maps the air quality in Portugal and in certain locations in Europe with alerts of *weak* or *bad* air quality.

Students get that air quality is not the same every day and it's different from place to place, from city to city and country to country. By exploring the website or app, students capture those different variables affect air quality: weather, gas emissions, location, fires, etc.

- ✓ **Greenhouse Gas Emissions:**

Students are introduced to the concepts of "burning fuel", "greenhouse gas emissions" and their impacts, as well as the meaning of "Road to Zero" and "carbon-neutral".
Students are asked to formulate and contribute with keywords to better understand each of the previous concepts in order to recognize the connection between greenhouse gas emissions and the transport sector impact.

- **Burning fossil** fuels releases carbon dioxide/greenhouse gases into the atmosphere.
- **Greenhouse gases** absorb energy from the Earth, trapping it in the atmosphere. This causes the temperature to rise, which drives climate change.

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- **Road to Zero**: Cars are the greatest contributor of greenhouse gases released by transport. If cars have zero emissions, then there will be a lower proportion of greenhouses gases in the atmosphere. This means that less energy is trapped, and the temperature increases less.
- **Carbon-neutral**: When a process does not increase the overall amount of carbon dioxide in the atmosphere because it takes in as much carbon dioxide as it releases.
- **Fossil fuel** powered road transport is the most significant source of transport related air pollution. Each vehicle releases pollutants from a set of sources.

In order to strengthen knowledge about greenhouse gas emissions and related concepts, students are challenged to individually respond to an **interactive digital quiz – Greenhouse effects. – New Digital Learning Object 1**

Lesson 3: Ecological footprint

✓ **Ecological Print – our individual role:**
Small group (4/5 students): Discussion around the questions:

- "Do you think your lifestyle follows the sustainable principles?"
- "How can you tell if your lifestyle is sustainable?"
- "How can we compare lifestyles?"

Students must measure/compare everything, leading them to the concept of "Ecological Footprint" as a unit to measure and compare different lifestyles. Our ecological footprint allows us to calculate how much pressure our lifestyle is putting on the planet.

➢ **Digital Learning Object 7: The ecological footprint calculator:** website (www.footprintnetwork.org) must be use first as a demonstration and then as a tool that helps each student/group to be aware that individual behaviour has an impact on the planet, especially the choice of mode of transport.

In order to engage students in the agenda of sustainability, they are challenged to make a commitment to reduce their ecological footprint by indicating how willing they are to modify their habits – (e.g., eating fewer animal products, adopting more environmentally friendly travel habits, saving on water consumption...) - **New Digital Educational Resource 20**: Ecological footprint commitment layout

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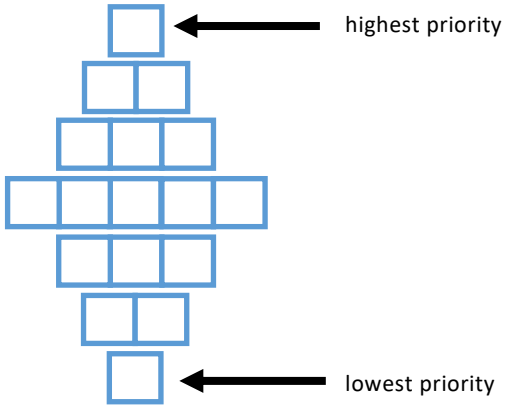
Lesson 4: EcoMobility

Sustainable Development and SDGs.

Students are asked if they know what is Sustainable Development and how many are the Sustainable Development Goals defined in the Global Agenda launched by the United Nations.
Sustainable development means that we need to reach this vision without preventing future generations from also being able to meet their needs.
The agenda includes 17 Sustainable Development Goals (SDGs) which aim to transform the world in areas that are critical for both people and the planet.

- Activity: After identifying all 17 SDGs, students are asked to choose the most important **- Digital Educational Resource 12-** Education for Sustainable Development Goals - UNESCO

The 17 SDG cards are projected by the teacher and each student has to place a diamond shaping the numbers for each objective to represent how would they prioritize the goals. Goals on the same row have equal priority.



- **Debate/Conclusion: Was it easy to decide which goals were the most important? If not, why?**

Many of these issues are interconnected, which means we can't address them on their own. For example, if we don't address poverty and provide everyone on the planet with a sustainable way to produce food, then we won't be able to protect ecosystems on land and below water, and we will fail to curb climate change.

SDGs and Sustainable Transport/Mobility.

Students are asked to map the contribution of Sustainable Mobility to the SDGs.
Sustainable Mobility contributes mainly to six of the 17 United Nations Sustainable Development Goals:

- ✓ SDG 8 - Decent work and economic growth
- ✓ SDG 9 - Industry, innovation and infrastructure
- ✓ SDG 11 - Sustainable cities and communities
- ✓ SDG 12 - Responsible consumption and production
- ✓ SDG 13 - Climate action

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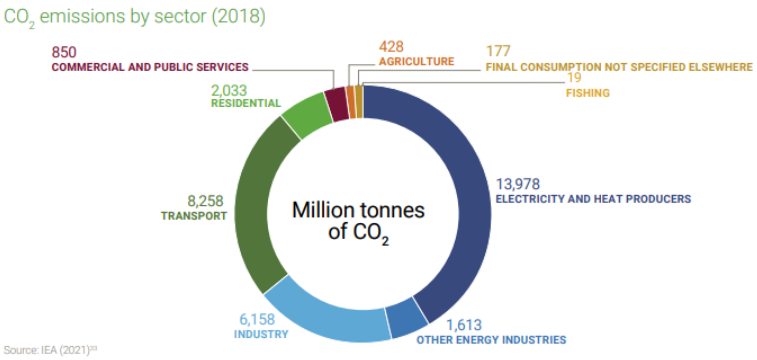
✓ **Combating climate change: impact of the transport sector:**



Based on the Sustainable Transport - Sustainable Development - UN report - **Digital Educational Resource 13**, students divided into groups of 5/6, must research the weight of the transport sector in the world's total energy consumption and in the emission of greenhouse gases and address the main ideas. The transport sector remains a significant contributor to GHG emissions and climate change, while at the same time being vulnerable to climate-related extreme weather and disasters, albeit with different levels of risk and exposure across modes and geographical localities. The ways in which transport systems evolve and adapt are central to reach sustainable transportation networks, which is critical to reduce the probability of climate change events.

National and international best practices in sustainable mobility.

To address the best national and international practices of sustainable mobility, it is proposed to groups of 5/6 students to choose one of the cities and present the best practices implemented by them to the class based on the following pdf document: We have the power to move the world – best practices – **Digital Educational Resource 14.**

Rethinking how we move around our shared landscapes is central to the effort to combat emissions. From offering free public transport during rush hour and tax discounts to electric cars, to building green corridors through public cycling systems, introducing bus rapid transit systems, and expanding pedestrian only zones, decisive action is already making a difference.

✓ **EcoMobility**

Students are organized in groups to discuss the advantages of using more environmentally friendly modes of transport that contribute to healthier and safer lifestyles.

Each group is responsible for presenting to the class each type of mobility pattern: public transport, shared mobility, integrated mobility and active mobility.

- Main advantages of the use of public transport (Means of economic transport; Less occupation of urban space; Facilitation of mobility within cities; Greater equity in access to mobility; Contribution to conservation and greater experience of cities).
- Shared mobility (Bikesharing; Carsharing; Scooter sharing, Carpooling).
- Integrated mobility - mobility using the combination of different types of travel (walking, public transport, individual transport...).
- Active mobility - healthy mobility with the use of physical exertion.

Travel planning on public transport – the importance of integrated mobility: each group chooses a starting point and a point of arrival planning the best way of travel using the applications : **Digital**

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Learning Object 8 App Moovit and/or Citymapper - The Ultimate Transport App, taking into account:

- Transport offer.
- Security.
- Schedules.
- Duration.
- Traffic fluidity.
- Cost.
- Walking route.

Lesson 5: Quality of life and road safety

Quality of life and road safety.

Advantages and disadvantages of modes of transportation and their impact on individual quality of life and public health: in pairs, students must identify and mark on a **New Digital Educational Resource 3,** a digital sheet, the benefits and disadvantages of active modes of transport and motor vehicles at an individual and collective level:

Active modes:
- ✓ Individual advantages: more physical exercise, contributes to physical well-being, reduces obesity; contributes to the better functioning of the respiratory system…
- ✓ Advantages at the collective level: contributes to the public health of all; influences the behaviour of others towards the practice of physical exercise, contributes to the reduction of air and noise pollution.

Motor vehicles:
- ✓ Disadvantages at the individual level (e.g., sedentary lifestyle; increases the likelihood of developing diseases; obesity, deafness, is exposed to polluting gases).
- ✓ Disadvantages at the collective level (e.g., increase in environmental and noise pollution).

Road risks and behaviours to adopt as vulnerable users.

Individually, students are asked to identify the elements that form the road environment and clarify the concepts associated with road environment and its composition: infrastructure, traffic signs, weather conditions, legislation, enforcement, road users (pedestrian, driver and passenger) and vehicles (cars, heavy vehicles – passengers and goods, 2-wheel vehicles (bicycles, mopeds, motorcycles…) and the definition of vulnerable users.

Through an infographic - How safe is walking and cycling in Europe - Digital Educational Resource 15 students will have a brief overview of road accidents at European level referring to vulnerable users.

Key questions to students:
1. What are the main road risks that cyclists face in traffic?
2. What are the main risks that pedestrians face in traffic?
3. What are the main risks for drivers of soft modes?

Students are divided into 3 groups: cyclist, pedestrians and drivers of personal transportation vehicles, and invited to explore the **booklet about vulnerable road users - New Digital Learning Object 2**, to identify the risks and dangers associated to each of the groups.

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After searching the learning object each group must create an infographic using Canva with the desirable behaviours to adopt as pedestrian, cyclist or driver of personal transportation vehicle. The final result is then presented to the class.

Lesson 6 - Quality of life and road safety

- How important is visibility distance in road safety?
- When driving at night and in conditions of poor visibility, is it even more important or not to ensure the visibility distance?
- Is the severity of road accidents related to force of collision– speed at the time of the accident?
- What is run over speed?

Students are introduced to the concepts of visibility distances; severity of accidents, the force of collision, and risk of get run over through a **New Digital Educational Resource 4, Retroreflective material: the importance of visibility - see and be seen.**

Retroreflective material: how it works and the importance of visibility - See and be seen at night and in low-light conditions.

How it works:

✓ Optical phenomenon of light reflection:
  - diffuse reflection and specular/regular reflection.
  - laws of light reflection.

✓ Retroreflective technology:
  - Microbead technology.
  - Microprism technology.

Viewing and analyzing the **video about Light Reflection Phenomena Digital Educational Resource 16** about the optical phenomenon of light reflection and its laws.

The importance of visibility:

- Advantages of retroreflective material.
- Visibility distances.
- Different applicability of the retroreflective material - clothing, accessories and vehicles.

Use of the new **simulator Be Seen – New Digital Learning Object 3 -** Identification of visibility distances of vulnerable road users with and without retroreflective material, especially in reduced visibility conditions or at night.

Students should individually explore each of the following scenarios in order to understand how far away is the vulnerable road user seen under the headlight lights:

- If they wear dark clothing, only 25 meters.
- If they wear light clothing, this distance doubles - 50 meters.
- If they use retroreflective material, the distance is 6 times greater – 150 meters.

In order to consolidate the concepts and the knowledge about the importance of wearing reflective material, its shown the **Reflective Material film – 3M - Video - Digital Educational Resource 17** that clearly demonstrates the difference between walking/riding with and without retroreflective material with evidence of the distances to which vulnerable road user is seen.

In order to assess and consolidate knowledge and attitudes regarding the issue of quality of life and road safety, students are invited to individually answer a digital and interactive **quiz – quality of life and road safety – New Learning Object 4.**

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Lesson 7-forward:

To better understand the mobility patterns of the school community, the teacher presents to the students the mobility patterns questionnaire – **New Digital Educational Resource 2**.

After analyzing and identifying the challenges regarding mobility patterns in their home to school journey, students are challenged to apply the mobility patterns questionnaire to their school community and family. Students collect data and build a poster/infographic with the results. This is the School Project described down, in autonomous section. **New Digital Educational Resource 21**: Step by step on applying a questionnaire

Supplementary learning resources and educational activities

During lesson 3 and 6 (or in the sessions devoted to the development of the research project) is desirable to organize:

1. Presentation Session of the Ecological Footprint Commitments signed in the Session 3 to parents and school community.
2. Meetings (teleconference) with road safety experts, policy makers, public health authorities, officers of the municipality working on road safety, data scientists, researchers of PAFSE consortium, among others.

School Research Project

Topics

- Sustainable mobility.
- Energy sustainability.
- Social and economic dimension.
- Environmental protection.
- Quality of life and road safety.

Challenge: Build a poster/infographic about your school community mobility patterns and its impacts on environment, health and road safety

Goal: Analyze the results of the mobility patterns questionnaire and build a poster/infographic about school community mobility patterns and the impacts on various aspects: environmental, health and road safety.

Development process:
The project is based on guided research about Sustainable Mobility and the data obtained through the mobility patterns questionnaire.

To address this challenge, students can draw their first thoughts from the lessons discussed in the classroom in this scenario and the supplementary educational activities. In a second approach students are asked to share their points of view with each other, and ask others about their own experiences and investigation process, sharing ideas. This will help them to think again about their initial thoughts and the path taken so far, possibly generating new perspectives that may enhance their final project. For example, this may be accomplished through a debate between groups of students about the five main topics. Each group is responsible for one of the topics and should write down their strengths and weaknesses and then present them for debate. One of the students will be the moderator of the debate.

After understanding the importance of adopting sustainable modes of transportation, students collect reliable data and real-life cases to propose measures. Students will advocate for actions that promote a more sustainable and safer mobility in their route from home to school. To address the mobility patterns

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indicators, students and school community are asked to fill a questionnaire and answer a set of questions, such as:

1. What is the distance between your school and your home?
2. Usually, what is your way of moving between home-school-home? (walking, cycling, car with parents, public transport, other...)
3. How long does it take approximately to get to school, by type of transport?
4. If you're going to school by car, you'll point out the top three reasons. (list a number of possible reasons, such as distance, habit, bad weather, risks of walking in traffic, other hazards, other reasons...)
5. When you use the car to go to school, do you always wear your seatbelt? Or do you put it half way? Do you always put your seatbelt on when you travel in the back seat of the car? Do you only put your seatbelt on when you travel in the front seat?
6. If you travel by bike to school, mark the main reasons. (list a set of personal and collective reasons, such as: it is good for health, it is more economical, faster, less polluting, other reasons)
7. If you travel by bike to school, do you always put on your helmet, or do you never wear it or depends on how far you go?
8. During your usual school journey, what dangers do you encounter most often in traffic? (mark the dangers and situations, such as: narrow rides, cars parked on sidewalks, lack of crosswalks, lots of traffic, speeding; absence of signals, others ...)
9. How do you rate your journey to school? (tick the option on a scale: very safe, safe, unsafe and very unsafe)
10. What measures would make it easier for you to get to school, on foot or by bike? (mark those you consider more and less important, such as: pedestrian walks, more walkways, pedestrian areas, lanes for cyclists, spaces to park bicycles at school, less traffic, others...)

During the learning process:

- Students will be able to incorporate evidence in their poster/infographic coming from reputable data sources to support their ideas and show media literacy.
- Students will be able to analyze quantitative evidence on the importance of a sustainable and safer mobility and their progress, to support their recommendations of strategies.

Teaching-learning process milestones:

1. Students will be able to incorporate evidence in their poster/infographic coming from reputable data sources to support their ideas and show media literacy.
2. Students will be able to identify and communicate evidence-based policy measures that promote sustainable and safer mobility and produce positive outcomes in the school and community settings.
3. Students will be able to suggest and advocate for action by different stakeholders, though data and scientific evidence.

Teaching-learning process for school project (summary):

1. Collection of evidence (data, information, reports, case studies).
2. Evaluation of the evidence based on criteria and selection of the relevant and non-biased information.
3. Identify effective presentation formats.
4. Produce the posters/infographics.
5. Present the poster/infographic in open schooling event and debate the need to change to a more sustainable and safer mobility and its impacts on the community.

Organization of the open schooling event:

1. Each project output (poster/infographic) is presented by the students to the community and debate the need to change to a more sustainable and safer mobility and its environmental, health and road safety impacts on the community.

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2. Students will communicate policy measures using science-based argumentation. Students appeal to the action of all in health and safety of the community, providing great understanding that health, environmental and road safety literacy and promotion are a responsibility of all.

Students, families, school community and relevant local stakeholders attend the event and understand how important is to change behaviour related to mobility patterns. They also get high-level understanding on strategies that minimize disease, environmental hazards and road safety impacts - and how they may have an influence on the relevant settings (e.g., home, school, workplace, public space at the community level).

Data Analysis and Reporting

Poster or infographic with the most important findings of possible measures implemented at the school to help improving sustainable mobility patterns based on science-driven data research.

Target Audience for Recommendations

School community and local stakeholders: students, parents, municipalities, healthcare providers, local enterprises.

Public Debate and Recommendations (based on research results)

Public presentation of the results by students in a community setting and dissemination of evidence-based recommendations via social, community and conventional media.

Main partner responsible:

Portuguese Road Safety Association – PRP

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Assessment Questionnaire- Knowledge, Skills, Beliefs, attitudes and behavior

Scenario topic: Sustainable Mobility

Knowledge	
1. Recognizes and characterizes patterns of Sustainable Mobility.	**Question 1.1:** What is Sustainable Mobility? A) a set of processes and actions aimed at the movement of people and goods, with a reasonable economic cost and at the same time minimizing the negative effects on the environment and on the quality of life of people, with a view to the principle of meeting current needs without compromising future generations. B) a development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. C) a long-term shift in temperatures and weather patterns that may be natural, such as through variations in the solar cycle. **Question 1.2:** Which one of these is a Sustainable Mobility pattern? A) use the bicycle to go to school daily; B) for short travels the car is always the best option; C) public transport isn't a good alternative for everyday car travels.
2. Identifies the principles of Sustainable Mobility and explains their relationship with the SDGs.	**Question 2.1:** What are the principles of Sustainable Mobility? A) politics, education, industry and optimism; B) technology, physics, justice and freedom; C) energy, economy, environment and quality of life. **Question 2.2:** How many SDGs are related to Sustainable Mobility? A) all 17 of them; B) 10; C) 5.
3. Recognizes the advantages and disadvantages of fossil and renewable energy and proposes general action to reduce air pollution and fight climate change.	**Question 3.1:** Which of these are renewable energy resources? A) oil, coal and wind; B) solar, water and biomass; C) nuclear, natural gas and geothermic. **Question 3.2:** What kind of mobility pollution has the most impact on health? A) visual pollution; B) air and noise pollution; C) none. **Question 3.3:** Which activity is the largest contributor of greenhouse gases? A) deforestation; B) industry; C) transportation.
4. Identifies the most important consequences of motorized transport in the environment, quality of life and road safety.	**Question 4.1**: What is NOT a consequence of motorized transport in the environment? A) greenhouse gas emissions; B) noise pollution; C) clear air. **Question 4.2**: What are the consequences of motorized transport on quality of life and road safety?

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	A) less urban space specially for vulnerable road users; B) improved health and time saving; C) safer roads.
5. Identifies the best national and international practices that promote Sustainable Mobility.	**Question 5.1**: Which cities made a C40 commitment to have healthier and safer streets? A) London, Oslo, Milan, Copenhagen and Paris; B) Medellín, Jakarta, Auckland, Seoul and Vancouver; C) all of the above. **Question 5.2:** What kind of Sustainable Mobility policies did these cities implement? A) revamped its entire bus network, changing fossil fuel vehicles for electric ones and redesigning the system to provide a more streamlined service with higher frequencies; B) reclaiming space for people as a vital way to fight against climate change; C) all of the above.
6. Identifies relevant action to address challenges related with Sustainable Mobility at the community and societal level.	**Question 6.1**: Select the action that DOES NOT address a challenge of Sustainable Mobility at a community level: A) give back the city to the people; B) expand bicycle infrastructure with new and wider bicycle tracks and more bicycle parking; C) promote the use of individual fossil fueled vehicles.
7.Recognizes relevant road risks for vulnerable road users and identifies appropriate actions to prevent or mitigate them.	**Question 7.1:** Who is a vulnerable road user? A) Pedestrians, especially children and seniors; B) Pedestrians, 2 wheelers and bus drivers; C) All road users. **Question 7.2:** What are the main road risks that vulnerable road users face in traffic? A) Drivers that don't give way to pedestrians and don't respect crosswalks; B) Distraction and Speeding of the car and motorcycle drivers; C) Poor visibility at night and low-light conditions; D) All of the above. **Question 7.3:** Select the appropriate actions to prevent or mitigate road risk: A) Better road safety education at school; B) More road safety campaigns; C) All of the above.
SKILLS	
1. Selects appropriate concepts, principles and evidence to characterize Sustainable Mobility.	**Question 1.1:** Which data sources may we use to proper understand what Sustainable Mobility is? A) International Institutions such as ETSC, EEA, ONU; B) Social media publications from unreliable sources; C) Data retrieved by google searches. **Question 1.2** To find scientific information about Sustainable Mobility I should consult the following sources. A) researchers, scientific publications and national and international experts' institutions.

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	B) friends, journalists, social media; C) google, radio, newspapers.
2. Can anticipate the consequences of different transport choices and user's behaviour in terms of Sustainable Mobility.	**Question 2.1:** Which individual actions can be taken to help promote a more sustainable mobility? A) use an integrated mobility option; B) choose the car no matter the distance; C) don't look for the better transport options for your travels. **Question 2.2**: Which individual behaviours affect negatively the goal of a more sustainable mobility? A) prefer to walk rather them use individual transportation in small travels; B) favor trains and boats over plane trips; C) buy a new car that runs on diesel.
3. Can adopt sustainable mobility patterns to achieve a healthier and safer lifestyle.	**Question 3.1:** I feel able to adopt sustainable mobility patterns that help me achieve a healthier and safer lifestyle. 1) definitely true... 5) definitively false. **Question 3.2:** I will try to change my mobility patterns in order to help me achieve a healthier and safer lifestyle 1) definitely true... 5) definitively false.
4. Rejects unsafe traffic behaviours in the interactions with her/his/they peers.	**Question 4.1:** Please identify which of the following is an unsafe traffic behaviour: A) riding an e-scooter without helmet and give a ride to a friend; B) driving under the influence; C) all of the above. **Question 4.2:** What can you do to prevent unsafe traffic behaviors of your friends: A) when being a car passenger answer their phone calls if he/she/they is driving; B) be sure that everyone has their seatbelt on before you start the journey; C) all of the above.
5. Can propose concrete actions towards adopting sustainable mobility patterns and safe traffic options by others.	**Question 5.1:** Please identify which individual protection gear is recommended when cycling? A) helmet and gloves; B) knee and elbow protection; C) all of the above. **Question 5.2:** As a pedestrian, which of the following behaviours are not safe? A) crossing the road on the crosswalk; B) use earphones while walking on the street; C) look left-right-left before crossing the road;
6. Feels able to influence the adoption of sustainable mobility patterns and safe traffic options by others.	**Question 6.1:** I feel able to influence others (family, friends, colleagues) to adopt individual attitudes in their day-to-day life that lead to more sustainable mobility (e.g., Preferring walking rather than driving by car, choosing public transport over driving a car). 1) definitely false… 5) definitely true. **Question 6.2:** I feel able to influence others (family, friends, colleagues) to adopt individual attitudes in their day-to-day life that lead to safer and

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	healthier mobility (e.g.: wearing a seatbelt, driving at low speeds). 1) definitely false… 5) definitely true.
7. Can identify the problems and challenges of the community in relation to Sustainable Mobility, connects them with SDGs and find the relevant resources to address them.	**Question 7.1:** I feel able to identify the main problems my community faces in relation to Sustainable Mobility. 1) definitely false… 5) definitely true. **Question 7.2:** I can understand how the Sustainable Mobility challenges my community faces are related to the SDGs. 1) definitely false... 5) definitely true. **Question 7.3:** I feel capable of proposing actions that address the SDGs related to Sustainable Mobility in my community. 1) definitely true... 5) definitively false.
Beliefs, attitudes and behavior	Include: There are no correct or incorrect answers; we are only interested in knowing your perspective.
1. Believes that Sustainable Mobility is a fundamental component of health and quality of life.	**Question 1.1:** Sustainable Mobility is a fundamental component of health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 1.2:** Sustainable mobility patterns will promote a better health and quality of life. 1) strongly disagree… 5) strongly agree.
2. Believes that is important to contribute to a more sustainable mobility.	**Question 2.1:** My actions will increase the chances of success of a more Sustainable Mobility. 1) strongly disagree… 5) strongly agree. **Question 2.2** I am physically and financially capable of adopting actions that contribute to a more Sustainable Mobility (e.g., use the car less times, prefer walking and cycling for short distances, use the public transports on a daily basis) 1) Extremely unlikely... 5) Extremely likely. **Question 2.3** My family and friends think that I should adopt actions that contribute to a Sustainable Mobility. 1) Extremely unlikely... 5) Extremely likely
3. Believes that individual choices influence Sustainable Mobility and Sustainable Mobility influences health and quality of life.	**Question 3.1** Sustainable Mobility influences citizens' health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.2** Using the car for every single need to travel influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.3** Preferring integrated mobility options influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.4** Choosing public transport over individual motorized transport influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree.

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	Question 3.5 Favoring shared mobility (bikesharing, carpooling, carsharing) influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.6** Active mobility (walking, cycling) influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.7** Access to different types of transportation modes influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree. **Question 3.8** Changing oil fueled vehicles to electric vehicles influences Sustainable Mobility, health and quality of life. 1) strongly disagree… 5) strongly agree.
4. Believes that it is important to adopt sustainable mobility patterns to prevent climate change and to be healthy and safe.	**Question 4.1** Youths should adopt sustainable mobility patterns to fight climate change and be healthy and safe in older ages. 1) strongly disagree… 5) strongly agree. **Question 4.2** The adoption of sustainable mobility patterns will contribute to fight climate change and to have a healthier and safer lifestyle. 1) strongly disagree… 5) strongly agree.
5. Reproves patterns of risky, unhealthy and unsafe behaviours, as a vulnerable road user.	**Question 5.1** The adoption of sustainable mobility patterns will ruin my image. 1) strongly disagree… 5) strongly agree. **Question 5.2** For me the adoption of sustainable mobility patterns in the next three months, would be: 1) Bad... 5) Good. **Question 5.3** For me to adopt more sustainable mobility patterns, in the next three months, would be: 1) useless... 5) useful. **Question 5.4** I don't accept patterns of risk, unhealthy and unsafe behavior in my mobility patterns. 1) definitely true... 5) definitively false. **Question 5.5** The people in my life whose opinions I value (family, friends) 1) will use ... 5) will not adopt sustainable mobility patterns in the next three months.
6. Adopts eco-friendly mobility patterns and believes that it contributes to healthier and safer lifestyles.	**Question 6.1** I believe that the adoption of eco-friendly mobility patterns influences people security, health and quality of life: 1) strongly disagree… 5) strongly agree. **Question 6.2** I will make an effort to adopt eco-friendly mobility patterns to in the next three months. 1) strongly disagree… 5) strongly agree. **Question 6.3** I plan to use more public transports in the next three months. 1) strongly disagree… 5) strongly agree.

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	Question 6.4 I plan to use active mobility (walking, cycling…) in the next three months. 1) strongly disagree… 5) strongly agree. **Question 6.5** I plan to use more shared mobility (carsharing, bikesharing, carpooling) in the next three months 1) strongly disagree… 5) strongly agree. **Question 6.6** I plan to use integrated mobility options in the next three months. 1) strongly disagree… 5) strongly agree. **Question 6.7** I plan to avoid car travels over more sustainable options in the next three months. 1) strongly disagree… 5) strongly agree. **Question 6.8** Among the following statements, choose the one that best describes what you currently think. 1) I do not have eco-friendly mobility patterns, and I also have no intention of doing so. 2) I do not have eco-friendly mobility patterns but I have been thinking about the possibility of starting to do so. 3) I never or rarely have eco-friendly mobility patterns, but soon I will start doing it on a regular basis. 4) I adopt eco-friendly mobility patterns regularly. 5) For more than six months I have always or almost always followed eco-friendly mobility patterns. 6) For several years now, I have adopted eco-friendly mobility patterns, and I will continue to do so.
7. Is committed to communicate and address the problems and challenges of the community in relation to the determinants of sustainable, secure and healthy mobility and to contribute to the SDGs.	**Question 7.1** I intend to identify the problems of the community in relation to the determinants of sustainable, secure and healthy mobility in the next three months. 1) Extremely unlikely... 5) Extremely likely. **Question 7.2** I intend to address the challenges of the community in relation to the determinants of sustainable, secure and healthy mobility in the next three months. 1) Extremely unlikely... 5) Extremely likely. **Question 7.3** Among the following statements, choose the one that best describes what you currently think. 1) I am not contributing to sustainable mobility patterns in my community, and I also have no intention of doing so. 2) I am not contributing to sustainable mobility patterns in my community, but I have been thinking about the possibility of starting to do so. 3) I am never or rarely have been contributing to sustainable mobility patterns in my community, but soon I will start doing it on a regular basis. 4) I am contributing to sustainable mobility patterns in my community regularly. 5) For more than six months I have always or almost always been contributing to sustainable mobility patterns in my community. 6) For several years now, I have been contributing to sustainable mobility patterns in my community, and I will continue to do so.

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8. Attitude towards Sustainable Mobility.	**Question 8.1** For me to adopt patterns of sustainable mobility is harmful :_____:_____:_____:_____:_____: beneficial pleasant :_____:_____:_____:_____:_____: unpleasant good :_____:_____:_____:_____:_____: bad worthless :_____:_____:_____:_____:_____: valuable enjoyable :_____:_____:_____:_____:_____: unenjoyable

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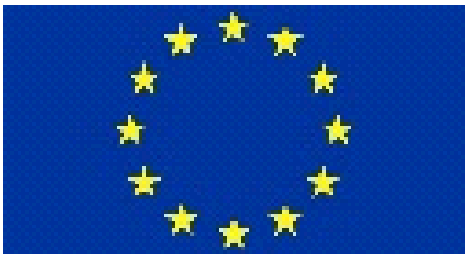
Partnerships for Science Education



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