Project Number: 101006468

Project Acronym: PAFSE

Project title: Partnerships for Science Education

EDUCATIONAL SCENARIO

JULY 2023

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006468.

1. Specifications for an educational scenario on the topic of " Risk Factors of Road traffic crashes"

Context

Road traffic crashes cause approximately 1.3 million deaths, and 20 to 50 million non-fatal injuries worldwide every year. More than half of all road traffic deaths and injuries involve vulnerable road users, such as pedestrians, cyclists, motorcyclists, and their passengers. Young people are particularly vulnerable in the world roads – road traffic injuries are the leading cause of death for children and young adults aged 5-29 (WHO, 2018).. The scenario supports mainly 9th grade teachers in exploring with students the factors contributing to outcomes in terms of injury, severity and fatality. The learning activities prepare students to follow a data-driven approach in addressing and mitigating risks, and so contribute to the reduction of burden from road traffic accidents at the community level.
The scenario aims to address the Sustainable Development Goals (SDGs), not only by contributing to the quality of education (SDG 4), but also by improving road safety and making the cities safer, especially for vulnerable road users (SDGs 3 and 11, targets 3.6, 11.2, 3.D). The scenario empowers students to adopt safe behaviours in traffic by creating awareness on risky behaviours, social influences, and modifiable risk factors, supports their participation in civic society initiatives and in the design of local responses for the issue, while providing significant interactions with the community (researchers, public health specialists, municipalities, policy makers, enterprises).

Scientific content and its relevance to public health education

To European Commission defined the goal to move to close to zero deaths on the EU roads by 2050 ("Vision Zero") and to halve the number of serious injuries by 2030 from a 2020 baseline. To reach these goals, the European Commission based its road safety policy framework for the decade 2021 to 2030 on the Safe System approach, whose core elements are ensuring safe vehicles, safe infrastructure, safe road use (speed, sober driving, wearing safety belts and helmets) and better post-crash care. The EC also stated that the mindset of "Vision Zero" needs to take hold both among policy makers and in the society (European Commission, 2020). The traffic safety and mobility education play an important role in strengthening and/or changing attitudes and intrinsic motivations towards risk awareness, personal safety and the safety of other road users in order to contribute towards a safety-minded culture. It is considered an essential part of an integrated approach to traffic safety, as education provides the possibility for people to learn how to participate in traffic safely. The aim of traffic safety and mobility education is to positively influence behaviour patterns that result in safer traffic. The transfer of knowledge and gaining an understanding of traffic rules and situations are the basis of traffic safety and mobility education (ETSC, 2020).

The scenario aims to contribute towards a safety-minded culture in traffic. Its content endorses teachers to play a key role in developing knowledge and skills for incorporating road safety as a central topic in their classes and in teaching public health science using high-level methods, high-quality learning objects, and updated evidence. It also challenges them to have a contribution for the community road safety by engaging families in educational activities and reaching the local community with inquiry-based projects and open schooling events leaded by students. The scenario also contributes to increase the interest in STEM (Science, Technology, Engineering, Mathematics) by providing an opportunity to develop a real-world research project in which students will develop and apply knowledge and skills learned in classes. The project also involves data collection, data manipulation, data analysis and communicating/discussing results based in scientific evidence.

Subject: Science classes
Grade: 9th grade (+/- 14-15 years old students)
Title of educational scenario: Road traffic crash risk factors

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Estimated duration

6 sessions of 40-45 minutes (lesson 1 – lesson 6)
5-6 sessions of 40-45 minutes for supplementary learning activities and school project (lesson 7 – lesson 12)

Classroom organization requirements

Students will work alone, in pairs and in groups under the coordination of the teacher.
The classroom should be equipped with:

- Tables
- Internet access
- Computers/tablets/laptops with internet access
- Projector
- Speakers
- Whiteboard or flipchart

Glossary

Content glossary:

Airbags: safety devices installed in vehicles that inflate to protect the driver or passengers in case of a collision.

Blood alcohol concentration (BAC): is the amount of alcohol present in the bloodstream, usually denoted in grams per decilitre (g/dl). A legal BAC limit refers to the maximum amount of alcohol allowed in the bloodstream that is legally acceptable for a driver on the road. In some countries, the law stipulates an equivalent quantity of alcohol in the air breathed out, in order to facilitate detection of drink-driving.

Braking distance: the distance taken to stop once the brakes are applied.

Breathalyser: an instrument that measures the relative quantity of alcohol in the air a person breathes out.

Change in velocity during a collision (ΔV): in crash reconstructions, the change in velocity occurring as a result of an impact – usually at the centre of gravity of the vehicle – is widely used as the measure of the severity of a collision. At substantial speeds, collisions between cars are almost totally inelastic so there is very little rebound. Thus, if a car travelling at 100 km/h strikes a stationary car of the same mass, they will both undergo a change in velocity of 50 km/hr. ΔV is an important measure of the input severity or energy dosage, that relates to the outcome or injury severity. It is therefore a widely used variable in assessing the characteristics of crashes and the benefits of various countermeasures, such as the use of seat-belts and air bags, and changes in speed limits.

Contributing factor: a contributing factor is a logical category into which one or more similar contributing circumstances are classified. For example, the contributing circumstances "condition – under influence of liquor/drug", "violation – over prescribed concentration of alcohol" and "violation – tested for drugs only" are categorised into the contributing factor of "alcohol/drug related".

Countermeasure: An activity or initiative to prevent, neutralize, or correct a specific problem.

CRAAP test: is a test to check the objective reliability of information sources across academic disciplines. CRAAP is an acronym for Currency, Relevance, Authority, Accuracy, and Purpose

Crash: Any accident involving at least one road vehicle in motion on a public road or private road to which the public has right of access, resulting in at least one injured or killed person.

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Data-driven: Informed by a systematic review and analysis of quality data sources when making decisions related to planning, target establishment, resource allocation and implementation.

Distracted Driving: Any activity that could divert a person's attention away from the primary task of driving. Includes activities such as texting or talking on a cell phone while driving.

Distracted/inattentive: where the controller is attributed with the contributing circumstance of "driver – inattention/negligence", "driver distracted – mobile phone" or “violation – driving without due care and attention”.

Drink driving: is attributed to the controller of a motor vehicle who had an illegal blood alcohol concentration (BAC) for their licence level, vehicle type or purpose of vehicle use at the time of the crash.

Driving under the influence (DUI) of alcohol, drugs, or a combination of alcohol and drugs: Operating a vehicle while the alcohol and/or drug concentration in the blood or breath, as determined by chemical or other tests, equals or exceeds the level established by the State, or is equivalent to the standard offense, for driving under the influence of alcohol or drugs in the State.

Enforcement: Actions taken to ensure compliance with legislation; traffic enforcement is usually done by the police

Evidence-based: Based on approaches that are proven effective with consistent results when making decisions related to countermeasure strategies and projects.

Excessive speed: driving at a speed higher than the maximum allowed.

Fact-checking: the process of checking that all the facts in a piece of writing, a news article, a speech, etc. are correct.

Fatal injury: According to the Vienna convention, a fatal injury is one that results in death within 30 days of the accident. Most highly motorised countries apply this definition of a traffic accident fatality.

Fatality: Death within 30 days of the road accident; confirmed suicide and natural death are not included.

Fatigue: is a reduction in driving or riding ability as a result of prolonged driving or being tired while driving. It should be noted that prolonged driving/ riding activity is not solely responsible for fatigue. Other factors such as the elapsed time since the person last slept, the time of the day or night, as well as the human circadian rhythm may be involved.

Haddon Matrix: Developed by William Haddon in 1970, the matrix looks at factors related to personal attributes, vector or agent attributes and environmental attributes; before, during and after an injury or death. By utilizing this framework, one can then think about evaluating the relative importance of different factors and design interventions.

Helmet: a protective device worn on the head to prevent injuries in the event of a crash.

Inappropriate speed: driving at too high a speed given the traffic situation, infrastructure, weather conditions, and/or other special circumstances.

Inattention: see without due care and attention.

Mass (of a vehicle): The mass of a body is its weight.

Mean speed of traffic: The mean speed of vehicles passing a measurement point on the road

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Passive safety/safety equipment: is 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.

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.

Post-crash response: is a sequence of time-sensitive actions, beginning with activation of the emergency care system, and continuing with care at the scene, care during transport, and facility-based emergency care.

Probability: The long-term frequency of occurrence of an event in repeated trials that have the event as one of the possible outcomes; how likely something is to happen.

Reaction distance: the distance travelled between the presentation of a sensory stimulus and the subsequent behavioural response; the distance travelled from the moment a driver observes a stimulus (e.g. sees a pedestrian or a changing traffic light) until the moment they have decided on their response (but have not yet initiated that response).

Reaction time: the elapsed time between the presentation of a sensory stimulus and the subsequent behavioural response; the time from the moment a driver observes a stimulus (e.g. sees a pedestrian or a changing traffic light) until the moment they have decided on their response (but have not yet initiated that response).

Risk factor: A factor that affects the probability of accident occurrence or the severity of the consequences of an accident.

Road infrastructure: road facilities and equipment, including the network, parking spaces, stopping places, draining system, bridges and footpaths. Roadside furniture: functional objects by the side.

Road safety: are approaches, strategies and measures used to prevent people from being killed or seriously injured in road traffic collisions.

Road safety indicators: Measures that enable to assess and monitor a road traffic system (country, region, …). Includes statistics from road traffic crashes, safety of vehicles and infrastructure, post-crash response, and road users' behaviours.

Road traffic accident: a collision involving at least one vehicle in motion on a public or private road that results in at least one person being injured or killed.

Road traffic crash: a collision or incident that may or may not lead to injury, occurring on a public road and involving at least one moving vehicle.

Road traffic fatality: is a death occurring within 30 days of a road traffic crash.

Road traffic injuries: are fatal or non-fatal injuries incurred as a result of a road traffic crash.

Road user: a person using any part of the road system as a non-motorized or motorized transport user.

Safety performance standards: definitions or specifications for equipment or vehicle performance that provide improved safety. They are produced nationally, regionally, or internationally by a variety of standard-producing organizations.

Seat-belt: vehicle occupant restraint, worn to protect an occupant from injury, ejection or forward movement in the event of a crash or sudden deceleration.

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Speed limit: The highest speed permitted by legislation; speed limits are often signposted.

Speed: The distance covered per unit of time; speed is often measured in kilometers per hour.

Speeding: Violations of the speed limit.

Star rating (vehicle)/ Car assessment programmes: are established at country, regional or global level, to assess safety performance of new cars using a star rating system which ranges from 0 to 5 (5 being the highest level of safety). These programmes are intended to provide consumer information on vehicle safety. Safety ratings are provided for different categories of users, including adult occupant protection, child occupant protection and pedestrian protection.

Stopping distance: the distance travelled between the time when someone decides to stop a vehicle moving, and the time when the vehicle completely stops. The total stopping distance is the sum of the perception-reaction distance and the braking distance.

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.

Travel speed: The mean speed of a vehicle between points A and B.

Victims: Total of fatalities, seriously injured and slightly injured and injured.

Visual field (field of view): The size of the area a person can see measured horizontally and vertically.

Vulnerable road users: road users most at risk in traffic, such as pedestrians, cyclists and public transport passengers. Children, older people and disabled people may also be included in this category.

Physics Glossary:

Acceleration: The rate at which the velocity of a body change with time, also the rate of change of the rate at which the position of a body changes with time.

Average speed of an object in an interval of time: is the distance travelled by the object divided by the duration of the interval;

Coefficient of kinetic friction: is a dimensionless scalar value which equals the ratio of the force of friction between two bodies and the force pressing them together, either during or at the onset of slipping.

Collision: is any event in which two or more bodies exert forces on each other in a relatively short time.

Deformation: the continuum mechanics transformation of a body from a reference configuration to a current configuration.[1] A configuration is a set containing the positions of all particles of the body.

Forces: Any interaction that, when unopposed, will change the motion of a physical body. A force has both magnitude and direction, making it a vector quantity. The SI unit used to measure force is the newton.

Friction: is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other.

Inertia: The resistance of any physical object to a change in its state of motion or rest, or the tendency of an object to resist any change in its motion.

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Instantaneous speed: is the limit of the average speed as the duration of the time interval approaches zero. Speed is not the same as velocity.

Kinetic energy: The energy that a physical body possesses due to its motion, defined as the work needed to accelerate a body of a given mass from rest to its stated velocity. The body continues to maintain this kinetic energy unless its velocity changes.

Mass: is the quantity of matter in a physical body. It is also a measure of the body's inertia, the resistance to acceleration (change of velocity) when a net force is applied.[1] An object's mass also determines the strength of its gravitational attraction to other bodies.

Motion: is the phenomenon in which an object changes its position with respect to space and time.

Newton's First Law, Inertia law: An object at rest remains at rest unless acted upon by a force. An object in motion remains in motion, and at a constant velocity, unless acted upon by a force

Newton's Second Law, Dynamic law: The acceleration of a body is directly proportional to, and in the same direction as, the net force acting on the body, and inversely proportional to its mass.

Newton's Third Law, Action-Reaction: When one body exerts a force on a second body, the second body simultaneously exerts a force equal in magnitude and opposite in direction to that of the first body.

Pressure: The ratio of force to the area over which that force is distributed.

Speed: is the magnitude of the change of its position over time or the magnitude of the change of its position per unit of time.

Velocity: A vector quantity defined as the rate of change of the position of an object with respect to a given frame of reference. Velocity specifies both an object's speed and direction of motion (e.g. 60 kilometres per hour to the north).

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 aproblem, 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.

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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.

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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The 5E Model (engage; explore; explain; elaborate; evaluate): developed in 1987 by the Biological Sciences Curriculum Study, promotes collaborative, active learning in which students work together to solve problems and investigate new concepts by asking questions, observing, analyzing, and drawing conclusions.

Indicative literature

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Competences / Learning Goals

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

Knowledge
Science concepts:
- The Haddon matrix.
- Task performance (walking, riding, driving)
- Movements and forces
-Distraction
-Alcohol absorption and elimination by the human body
- Road safety indicators: road crash statistics (number of crashes, deaths, injuries, rates);
- Data-driven science study
-Survey
- Population, sample, and database.

Public health concepts:
- Public health.
- Major public health causes of death and disability.
- Contributing factors for road traffic crashes.
- Risk factors in traffic: speeding, driving under the influence of alcohol/drugs, fatigue, distraction, Safety equipment.
- Road safety countermeasures.
- Road safety – performance and indicators.
- Burden of road traffic accidents.

Social concepts and global concerns:
- Road safety, urbanisation trends.
- Sustainable Development Goal (SDG).

Knowledge - outcome assessment:
1. Recognizes that road traffic crashes are a leading cause of premature death and pose a significant economic and societal burden.
2. Recognizes major contributing factors for road traffic injury.
3. Identifies which and how road system elements can contribute to reduce road crashes and the severity of its consequences.
4. Explains how different risk factors influence task performance and increase the probability of an accident.
5. Knows the steps of a data-driven science study. Define population and sample.

Skills (abilities/competences):
General: critical thinking; curiosity; problem-based learning; teamwork; collaboration; argumentation; self-awareness; citizenship; public speaking and active debate/ participation.

Specific:

- Finding, analyzing, and interpreting scientific data, texts and dynamic graphical representations to characterize road crashes and contributing factors.
- Identifying and understanding the multifactorial nature of the causes and risk factors of road traffic crashes.
- Understanding the relevance of data and scientific evidence to explain phenomena related to road crashes.
- Collecting and organizing data and choosing appropriate instruments to present the results (e.g., tables, graphs, infographics).

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- Obtaining, assessing, and communicating evidence related to road crashes risk factors.
- Mapping sources of risk, the dynamics between factors, behaviour, and outcomes in terms of road traffic injury.
- Analyzing personal and community risks, and patterns of risky and protective behaviour.
- Describing appropriate strategies to reduce personal and community risk and getting access to the relevant resources.

Skills – outcome assessment:

1. Selects appropriate data sources and indicators to characterize road traffic injuries at different levels (international/national/local).
2. Can anticipates the consequences of inappropriate behaviours in traffic.
3. Rejects unsafe behaviours in traffic.
4. Can propose concrete action towards adopting safe behaviours in his/her routine.
5. Be able to influence others towards the adoption of safe behaviours and removes or mitigates sources of risk.
6. Can identify problems and challenges of the community in relation to road safety.
7. Can identify the type of countermeasures which increase the level of security at the school, community, and societal level.
8. Is able to carry out a data-driven science study.

Affective /Attitudes/ Behaviour (*beliefs)*

- Believing that human behaviour influences the risk of road crashes and the severity of the outcomes.
- Adopting general risk perception attitudes related to road crashes risk factors.
- Reproving patterns of risky behaviours in traffic.
- Influencing peers to adopt safe attitudes and behaviour.
- Adopting safe attitudes towards minimizing risks in traffic.
- Adopting a safe behaviour in traffic as a pedestrian, rider, driver or passenger.
- Creating community awareness on the global sources of risk based on the Haddon Matrix (host-agent-environment).

Affective, Attitudes and behaviour - outcome assessment:

1. Believes that road traffic injuries are preventable because the risk of crash is largely predictable.
2. Believes that the attitudes and behaviours of humans largely impact road safety.
3. Believes that individual choices impact themselves and others' safety.
4. Reproves patterns of risky behaviour in traffic.
5. Actively avoids exposure to risk factors.
6. Is committed to reduce the health and societal burdens of road traffic accidents.
7. Engages public speaking and debating of measures to reduce sources of risk connected with the host (human), agent (vehicles and equipment) and environment.

Learning goals and outcomes

- Characterizes health and societal burden of road traffic injuries.
- Identifies the main sources of risk and patterns of risky behaviour in traffic.
- Analyses the consequences of safe and unsafe behaviours in traffic.
- Identifies and deconstructs beliefs and myths associated to each crash risk factor through evidence-based thinking.
- Plans and executes a data science research project to assess performance on road safety indicators and communicates the results.
- Uses statistical evidence to propose measures that improve road safety at the community level.
- Identifies sources of risk in the school community.
- Obtains, evaluates, and communicates data and scientific information about road traffic crash risk factors.

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Assessment methods

- ✓ Outcome assessment:
  - Quantitative – questionnaire in paper.
  - 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**

The Haddon Matrix (risk factors of road traffic injuries).

1. Road traffic crash risk factors - physics:
   - Newton's First Law, Inertia law
   - Newton's Second Law, Dynamic law
   - Newton's Third Law, Action-Reaction
   - Speed
   - Inertia
   - Mass
   - Forces
   - Movement
   - Friction
   - Velocity
   - Acceleration
   - Deformation
   - Coefficient of kinetic friction
   - Collision
   - Pressure
   - Kinetic energy
   - Energy Dissipation

3. DUI - Driving under the influence:
   - Absorption of alcohol/drugs and medicines by the human body
   - Elimination of alcohol/drugs and medicines in the human body
   - Widmark formula (how BAC level is calculated)
   - Distraction (use of mobile phone):
   - Distraction (attention; Selective attention vs divided attention)
   - Types of distraction (cognitive, visual, manual, auditory)

Digital learning objects (DLO)

New DLO's (*developed by the project team*):

1. New DLO Stopping distance (simulator)
2. New DLO – Field of view, speed impact (simulator)
3. New DLO – Impact Speed on a Run-over (Simulator)
4. New DLO – Speed (Quiz)
5. New DLO Crash Forces calculator (simulator)

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6. New DLO –Safety equipment - Myths and Beliefs (Quiz)
7. New DLO - Distraction (Drag & Drop)
8. New DLO - BAC (simulator)
9. New DLO – Risk of accident and effects of alcohol on the human body (infographic)
10. New DLO - Alcohol - Myths and Beliefs (Quiz)
11. New DLO - Step-by-step questionnaire on road accident risk factors (power BI)

Digital Educational Resources (DER)

1. New DER - Road crashes, the health and societal burden (powerpoint)
2. New DER – CRAAP – checking technique (infographic)
3. New DER - Road system elements (infographic)
4. New DER Haddon Matrix (infographic)
5. New DER - Task performance in traffic (infographic)
6. New DER – Field of view (infographic)
7. New DER – How many collisions do you think that happen in a crash accident? (infographic)
8. New DER - collision interval time and pressure (infographic)
9. New DER – Attention game (image - calculation sequence + text - with a story + grid – accounting of errors and questions)
10. New DER –Types of Distraction (infographic)
11. New DER – Fatigue (infographic)
12. New DER – Alcohol absorption and elimination (infographic)

From other sources (only a few of these will be selected for the final scenario):

13. DER – Old and new car crash test (video) https://www.youtube.com/watch?v=C_r5UJrxcck
14. DER – Crash test without seatbelt and with seatbelt (video) https://youtu.be/hNw1-OPwiKs
15. DER – Airbag Crash test (video) How do airbags work? - YouTube

Complementary

Road Crashes:

Leading causes of death in the world

- Top ten causes of death worldwide (WHO): https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death; https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death
- Causes of Death (Our World in Data): https://ourworldindata.org/causes-of-death

Road safety statistics in the World/Europe/Countries

- Death on the Roads (WHO): https://extranet.who.int/roadsafety/death-on-the-roads/
- Road traffic mortality (WHO): https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/road-traffic-mortality

Road safety indicators based on survey data

- E-Survey of Road Users' Attitudes: Website; link to dashboard

The Global status report on road safety 2018, *launched by WHO in December 2018*
Global status report on road safety 2018 (who.int)
https://www.eltis.org/in-brief/news/new-ec-thematic-reports-and-facts-and-figures-road-safety-issues
Publications | ETSC

Road Traffic Crashes Risk Factors:

https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries (road traffic injuries; risk factors)
https://www.roadsafety-dss.eu/#/risk-factor-search (risk factors)
https://ec.europa.eu/transport/road_safety/statistics-and-analysis/data-and-analysis/thematic-reports_en (thematic reports - speed, alcohol, fatigue, …)
https://prp.pt/prevencao-rodoviaria/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006468.

Speed:
https://etsc.eu/reducing-speeding-in-europe-pin-flash-36/
Speed and Crash Risk | ITF (itf-oecd.org)
Managing speed (who.int)
https://ec.europa.eu/transport/road_safety/statistics-and-analysis/data-and-analysis/thematic-reports_en

Safety equipment's (Non- use of Seatbelt, Helmets, Headrest, Vehicle):
https://www.euroncap.com/en/car-safety/the-ratings-explained/adult-occupant-protection
https://etsc.eu/position-paper-vehicle-roadworthiness-package-implementation-reports/

Distraction (use of mobile phone):
https://swov.nl/en/fact-sheet/distraction-traffic
Publications | ETSC
https://ec.europa.eu/transport/road_safety/statistics-and-analysis/data-and-analysis/thematic-reports_en

Fatigue:
https://www.swov.nl/en/facts-figures/factsheet/fatigue

DUI - Driving under the influence (Alcohol/drugs):
https://www.labxchange.org/library/items/lb:LabXchange:31f6c5bb:video:1
https://etsc.eu/7-smart-ways-of-tackling-drink-driving-in-europe/
https://ec.europa.eu/transport/road_safety/statistics-and-analysis/data-and-analysis/thematic-reports_en

Other risk factors (the Handon Matrix):
Table 3.2, Risk Factors of Road Traffic Injuries: The Haddon Matrix - Injury Prevention and Environmental Health - NCBI Bookshelf (nih.gov)

Fact-checking

- The CRAAP Test - Evaluating Sources - Research Guides at Benedictine University Library
- https://southcentral.edu/webdocs/library/CRAAP%20Test%20Worksheet.pdf

Teaching -learning activities

Science classes – 9th grade – 4-6 sessions of 40-45 minutes
Science classes
9th grade (+/- 15 years old students)
6 sessions/classes with the duration of 40-45 minutes
Science teachers integrate other colleagues in the enactment of the scenario (e.g., physics, chemistry, ICT, mathematics, citizenship and English teachers), as it aims to be interdisciplinary.

Lesson 1 - Road crashes a public health problem
Teacher divides the class into groups of students and each group works on one of the following topics:

- Road accidents as a public health issue (Why Road accidents are a public health issue?)
- Crash contributing risk factors (What are the major contributing factors for road crashes?)
- Why is it so important to verify factual information, in order to promote the veracity and correctness of reporting?

Then some links will be given to students to search, explore and collect the information about the topics.

Leading causes of death in the world

- Top ten causes of death worldwide (WHO): https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death; https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death
- Causes of Death (Our World in Data): https://ourworldindata.org/causes-of-death

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Road Traffic Crashes Risk Factors:

- https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries (road traffic injuries; risk factors
- https://prp.pt/prevencao-rodoviaria/

Fact-checking

- The CRAAP Test - Evaluating Sources - Research Guides at Benedictine University Library
- https://southcentral.edu/webdocs/library/CRAAP%20Test%20Worksheet.pdf

After exploring and search information about the topics students will present their findings to the class and debate around the 3 topics is organised.

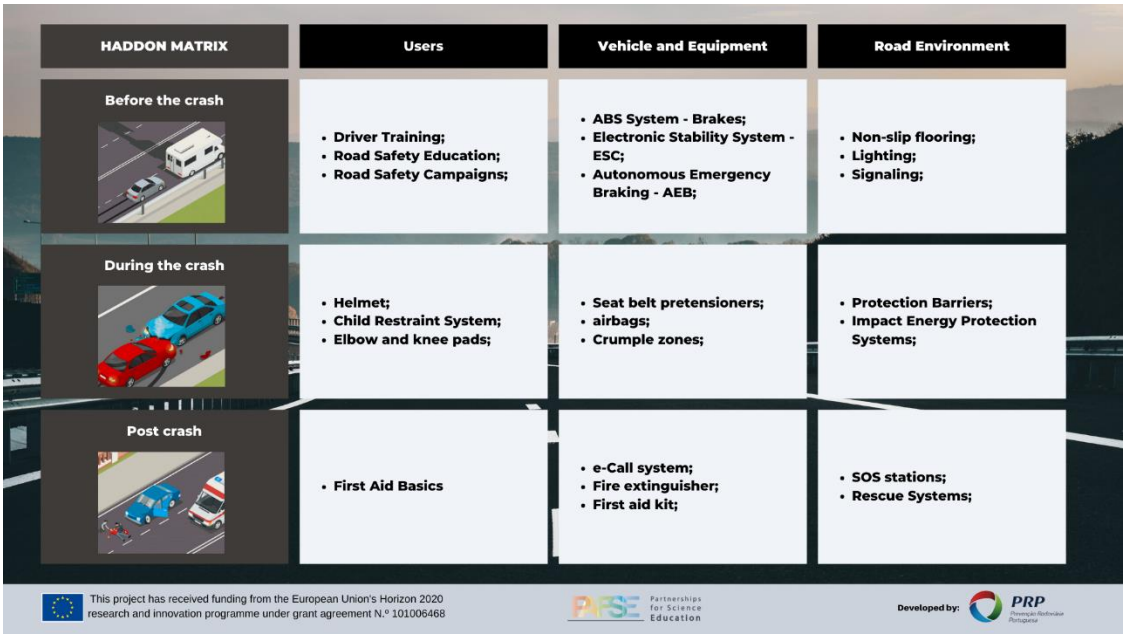
The teacher with the support of **New DER 1 - Road crashes, the health and societal burden (powerpoint)** reinforces the economic and societal burden from road crashes with different sources of data (e.g.: WHO database, EUROSTAT, SDG tracker). Students understand that accidents are a major public health problem, a leading cause of death and disability, addressed by the Global Goals (SDG 3, target 3.6). and capture the major contributing factors for road crashes.
The teacher uses the **New DER 2 – CRAAP – checking technique (infographic)** to highlight the importance of identifying and looking for trustful sources of information and shows the CAART checking technique.

Teacher launches the following question:

- Which elements does the road system comprises?

Teacher presents on the whiteboard an image of 3 empty interrelated circles. Teacher invites students to identify the three elements of the Road system (human factor, vehicles, infrastructure)**.** Then students are invited to assign to each element of the system, the percentage they consider that most contributes to road accidents. After some debate, the teacher will show the right answers and students will conclude that more than 90% of road crashes have human factor involved **New DER 3 - Road system elements (Infographic).**

To conclude, the teacher will show the **New DER 4 - Haddon Matrix (Infographic),** with examples of safety measures, before, during and after the accident, reinforcing that to reduce the risks and consequences of an accident, theoretically, we have to improve the performance of the 3 elements of the road system.



Lesson 2: Speed - Road Traffic Crash risk factor

- The teacher launches the question: "What tasks does a person perform whilst walking, riding or driving?"

After debate the teacher presents an image **New DER 5 - Task performance in traffic (infographic)** showing and explaining which tasks a person performs whilst walking, riding or driving (Collect information; Anticipation, Decision, Action) and how the road traffic risk factors previously identified influence task performance. Students understand that all tasks are interdependent and when one is affected, the performance of the following one is also influenced (e.g., if we are distracted by the mobile phone, we miss important information that comes from road environment, we will predict and decide with lack of information, which will in turn increase the likelihood of errors and inadequate decisions, also increasing reaction time to stimulus and thus the risk of a road crash).

Teacher presents the **New DLO 1 - Stopping distance (simulator)**. The simulator allows teacher/students to distinguish, explore and calculate stop distances = (reaction time/distance + breaking distance) at different speeds with different reaction times, different levels of friction (dry, rain, snow) and different distances to an obstacle. The simulator calculates speed at the time of collision and demonstrates the consequences if the driver was not using a seat belt.

- Teacher launches the following question to the same groups: What happens when a vehicle is moving, the driver sees an obstacle and needs to break?

Each student of each group is invited to explore the simulator and makes different simulations using different variables (reaction time, speed, pavement) and take notes of the results. Then among them they compare and discuss the different simulations results and the impact of variables in stop distances, reaction time/distance and breaking distance.

Each group will present their own conclusions and the teacher, supported by the simulator, should reinforce the following concepts:

- The higher the speed the breaking and stopping distance are also much longer
- Small differences in speed can lead to a road crash or run-over since the breaking and stop distance increases.
- The greater the friction, the shorter the braking and stopping distance
- When reaction time increases the reaction distance and stop distance increase as well which can lead to an increase of the risk of accident.
- Safety distance is the distance that allows a driver to stop the vehicle on a free space in front of him, avoiding any collision.

Lesson 3: Speed - Road Traffic Crash risk factor

The teacher launches the following questions and promotes a brainstorming:

- What is the field of view?

Students are invited to share their opinion and then teacher show and ask students to interpretate the following image. **New DER 6 – Field of view (Infographic)**

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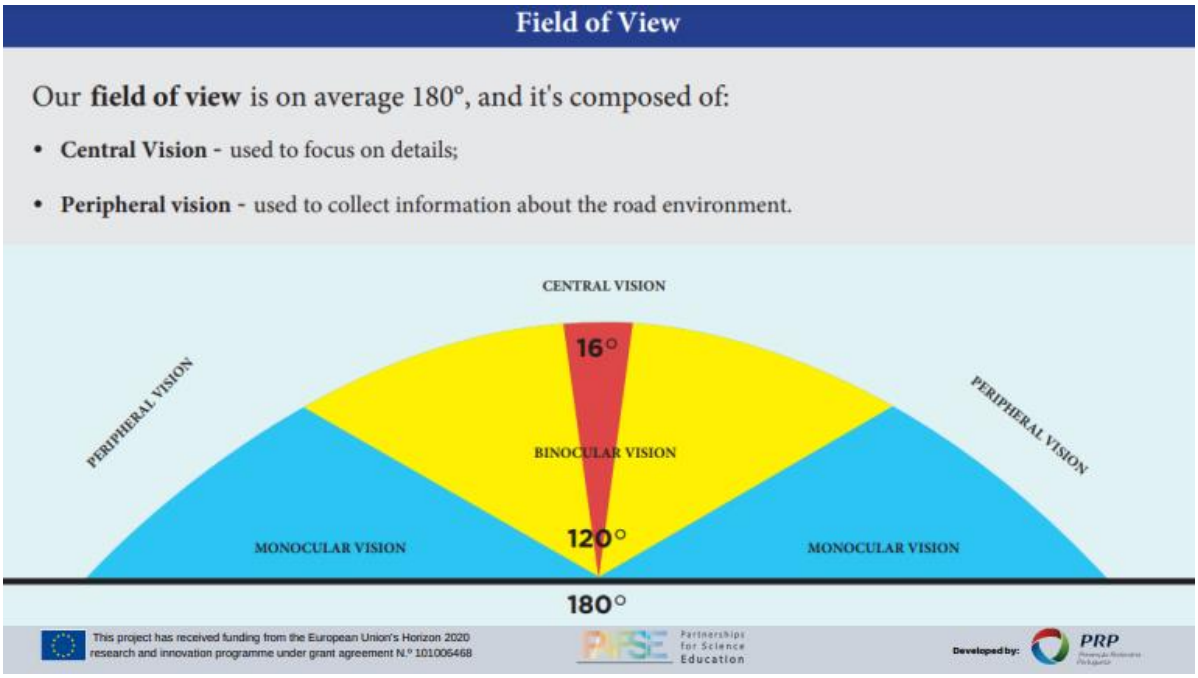

Together, Teacher and students conclude the field of view is 180‘degrees, that central vision is used to focus on the details and peripheral vision to gather information about the surroundings.

Teacher launches the following questions:

- How is our field of view affected by speed?
- Which factors influence the field of view?

After a debate student’s contributions are written in the whiteboard and teacher will invite students to explore the **New DLO 2 – Field of view, speed impact (simulator).** This DLO will allow students to simulate the impact of different speeds in the field of view.
Students with the support of teacher should conclude the following:

- As speed increases, the field of view tends to decrease and the focal length increases.
- The drivers’ field of view narrows as they drive faster, which means that drivers are less able to estimate potential hazards.
- Vision makes it possible to recognize a wide variety of information: colors, shapes, movements, distances and relief. When the scrolling speed is too high, the cells of our retina do not have time to separate the visual impressions. Our eyes cannot therefore follow and distinguish the details.
- The field of view is affected by many factors. The night reduces the visual field, at the same time as it reduces contrasts, the perception of colors, visual acuity... and it increases glare. Age and fatigue narrow the field of view. Diseases related to the eye or the processing of visual information. Alcohol narrows the field of view and changes the visual information.

The students are organized in groups with the purpose of exploring the **New DLO 3 – Impact speed on a Run-over (Simulator)** using different speeds and distances and fill the following table. Students will be asked to analyse the relationship between speed, collision speed and pedestrian probability of death in a run-over situation.

After simulations, students discuss results, reach conclusions and share with other groups the simulation’s results.

Vehicle Speed (km/h)	Impact Speed (Km/h)	Pedestrian - Probability of

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		Death (%)

The teacher launches the debate through the following conclusions:

- The collision severity as a direct relationship with speed. In a high-speed impact, the risk of injury and death is much higher.
- The human body has shock resistance limits and after impact at a certain speed a person does not survive.
- Small excesses of speed in urban areas have major consequences for pedestrians, increasing the probability of death and injury.

To consolidate knowledge and deconstruct myths and beliefs associated to speed, students will be invited to answer the quiz **New DLO 4 - Speed (Quiz)** Example: The use of a mobile phone during driving task doesn't have an impact on reaction time; The speed limit should decrease if the probability of a conflict with vulnerable users (pedestrians, cyclists, etc.) increases.

Lesson 4 - Safety equipment - Road Traffic Crash risk factor

The teacher launches the following questions and promotes a brainstorming:

- What kind of safety equipment do you know?
- Why is safety equipment so important when a road crash happens?

After brainstorming teacher shows the following video to students **DER 13 - Old and new car crash test (video)** https://www.youtube.com/watch?v=C_r5UJrxcck (Road crash test between a new and old vehicle where differences in consequences for drivers are considerable)

Then students watch the video and the teacher launches a debate around the reasons beyond the differences in terms of consequences in both cars and passengers. During the debate importance of safety equipment such as the crumple zones, seat belt, airbag, headrest must be highlighted. Together teacher and students make the link to the following concepts, action-reaction law, kinetic energy, deformation, deceleration, energy dissipation, time interval that the collision lasts. The vehicle safety rating depends on the security systems and teacher shows where they can learn more about vehicles safety ratings https://www.euroncap.com/en

The teacher launches the following question and promotes a debate:

- **Why are the seat belt and headrest in cars so important and how they work?**

After debate teacher makes the link with Law of Inertia or Newton's 1st Law and invites students to watch the video **DER 14 - Crash test without seatbelt and with seatbelt (video)** https://youtu.be/hNw1-OPwiKs

Teacher presents and explains how **New DLO 5 - Impact force calculator (simulator)** works. Crash force simulator allows, by selecting variables such as collision speed and person's height, the calculation of the impact force to which a person is subjected in case of collision.

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The teacher invites students in pairs, to calculate the impact force to which each of them is subjected in case of a collision at different speeds using their own height.

Teacher highlights the importance and explain that seat-belts reduce the risk of contact with the interior of the vehicle, reduce the severity of injuries if this occurs; distribute the forces of a crash over the strongest parts of the human body; prevent the occupant from being ejected from the vehicle in an impact; prevent injury to other occupants (for example in a frontal crash, unbelted rear-seated passengers can be catapulted forward and hit other occupants). The headrest helps to prevent the type of neck whiplash that leads to the majority of serious neck injuries.

Teacher shows **New DER 7 - How many collisions do you think that happen in a crash accident? (infographic)** and explains the 3 collisions that occur when a road crash happens (first collision (vehicle/object), second collision (occupant/vehicle interior) and third collision (internal organs of the body hit against the chest wall or the skeletal structure).

Teacher launches the following question:
How do airbags work?

After debate teacher invites students to watch the following video - **DER 15 - Airbag Crash test (video)**
How do airbags work? - YouTube

The teacher introduces and explains the concept of impulse and pressure and explain how safety equipment works (seat belt, airbag and helmet), the importance to reduce the pressure exerted by the forces during the collision. This can be done by increasing the area of surfaces on which the forces act. Seat belts, airbags and helmets reduce the pressure exerted on passengers, as the forces acting during a collision are distributed over a larger area.

New DER 8 - Collision interval time and pressure (infographic). To conclude teacher shows an image explaining how do seatbelts, helmet and airbags work, and reinforces that:

- seat belts, airbags, helmets make it possible to increase the collision time interval and, in this way, reduce in the event of a crash, the force exerted by the obstacle on the same vehicle.
- Seat belts, airbags and helmets reduce the pressure exerted on passengers, as the forces acting during a collision are distributed over a larger area. Pressure formula **P=F/A**

To consolidate knowledge and deconstruct myths and beliefs associated to safety equipment students are invited to take the quiz. **New DLO 6 - Safety equipment - Myths and Beliefs (Quiz)**
Example: "*The driver does not need to fasten his seat belt, because in the event of breaking or an accident he can hold on to the steering wheel and resist the collision."*

Lesson 5: Distraction and Fatigue - Road Traffic Crash risk factor
Distraction

Students are divided in groups of 4 and the teacher will present and explain **New DER 9 - Attention game (image - calculation sequence + text - with a story + grid – accounting of errors and questions)**
The group members who have the exercise with the mathematical calculation in front of them have 1 minute to solve it (executor). All pupils start at the same time. In the meantime, another pupil in the group will read a story, just once. The aim is to memorize as much information as they can from the story, while solving the mathematical calculation, and then reproduce it.

Teacher launches the following questions and promotes a debate:

What is attention?

Is it possible to do two things at once?

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What happens when people try to do two things at once?

The teacher asks the students what types of distraction exist and how they interfere with the task of driving or when walking on the street. After the discussion with the support of the **New DER 10 - Types of Distraction (Infographic)** introduces the various types of distraction.

Students are asked about lessons learnt and take their conclusions on the activity. Students understand that it is impossible to do 2 tasks simultaneously, keeping high levels of performance and when two tasks compete with each other some information is missed, and errors occur. The link with the use of mobile phone whilst walking, riding or driving must be done.

After a discussion, the teacher with the support of **New DLO 7 - Distraction (Drag & Drop)** should give the definition and explore the concepts of:

- What is attention?
- Selective attention vs divided attention.
- What are the consequences when people try to walk, ride or drive whilst using their mobile phone making the link with Attention game?
- Types of distraction - Cognitive (divided attention, more errors); Visual (miss information); Manual (impact on driving performance, ex. swerve more); Auditory (not listening to emergency signs or a horn)

Fatigue

The teacher shares with students that fatigue whilst driving is estimated to contribute to around 10-20% of traffic accidents in the European Union.

The teacher designs a table with 4 columns on the whiteboard or flipchart and students are asked and by the teacher to fill in the 4 columns answering the following questions:

- What are the causes, effects, symptoms of fatigue?
- Which groups are most at risk?

Fatigue			
Causes	**Symptoms**	**Effects**	**Risk groups**

After some discussion, the teacher presents or adds the missing elements in each column using **DER 11 - Fatigue (Infographic)**

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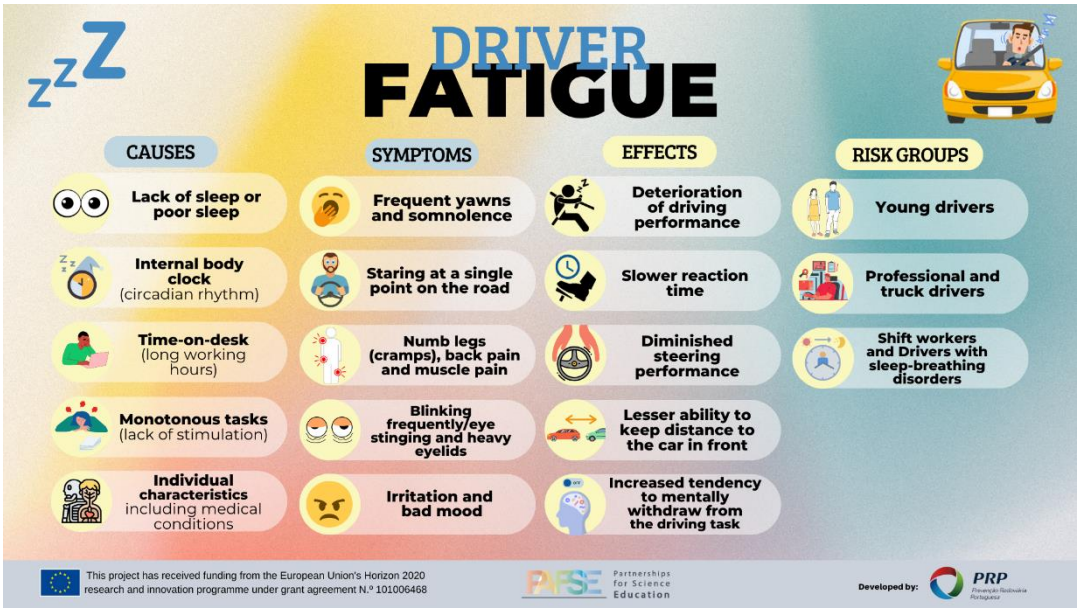

By the end, the teacher highlights that the **only way** to solve fatigue is by sleeping.

Lesson 6: DUI - Driving under the influence (Alcohol) - Road Crash Risk Factors

DUI (driving under the influence of alcohol) impact on road crashes

Teacher launches to the classroom the following questions:

- What is the presence of alcohol in the body?
- How can bac level be calculated?

After debate teacher and students must conclude the presence of alcohol in the body is calculated through the blood alcohol concentration (B.A.C.) that is usually expressed in grams of alcohol per litre of blood (g/l). The quantification of the level of alcohol in the blood is carried out by a test on the expired air, carried out in a quantitative analyzer or by blood analysis. A Breathalyzer is an instrument intended to measure the mass concentration of alcohol per unit volume in expired alveolar air.

Teacher invites students to explore the **New DLO 8 - BAC (simulator).** The BAC simulator allows to calculate BAC levels by doing simulations with different types and amounts of beverages and using different variables that influence alcohol absorption and elimination in the human body such as gender, weight, meal. The simulator will be developed based on the 'Widmark formula'. The Widmark formula provides only an approximate indicator of the TAS (ERSO, 2006).

Teacher invites students to use the simulator and calculate BAC levels using their own data, gender, height, and try different simulations with different amounts of alcohol consumption, different beverages, with and without a meal.

Teacher should promote a debate about what the blood alcohol level depends on, such as number of beverages, type of drink, weight, gender, type of ingestion, presence/absence of food, individual drinking habits and why the variables interfere with BAC level.

Teacher divides the class into groups.

- Some groups will be invited to answer the questions "How alcohol is absorbed by the human body? What factors influence the rate of absorption of alcohol?
- Others groups will be invited to answer the questions "How alcohol is eliminated by the human body?" What factors influence the rate of elimination of alcohol? Can we intervene in the alcohol elimination process?

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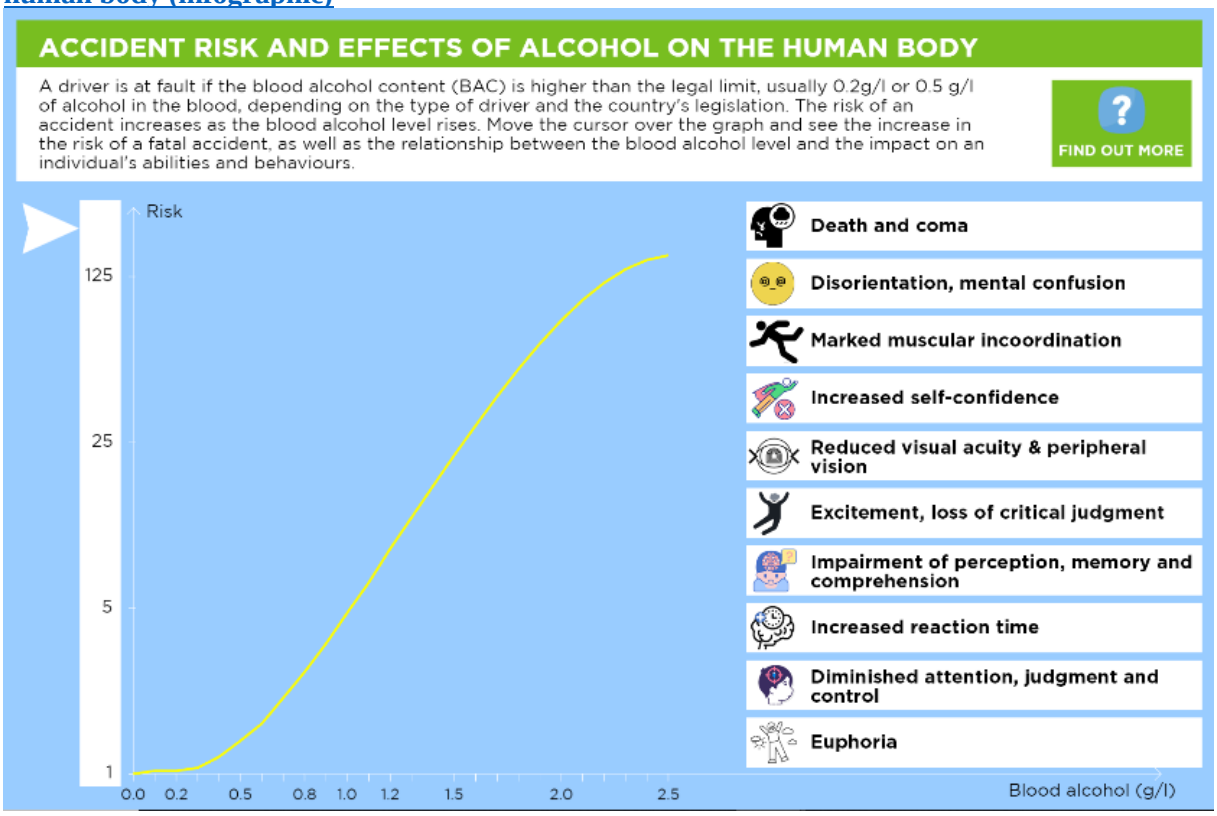
After debating these topics, the teacher with the support of **New DER 12 - Alcohol absorption and elimination (infographic)** consolidates the following concepts:

- ✓ how alcohol is absorbed by the mucous membranes of the mouth and oesophagus, the stomach and large intestine and by the proximal portion of the small intestine - absorption takes between 15-20 minutes, and there are factors that can change the speed of absorption;
- ✓ how alcohol is eliminated through sweat, urine, saliva and breath. The rest (90% to 98%) is metabolized by the liver to acetaldehyde.
- ✓ The liver metabolizes concentrated ethanol in the blood at an average of 0.1g/l per hour. It's a very slow process. Some studies show that women have lower amounts of the enzyme alcohol dehydrogenase (ALDH) than men (Pedrosa, 2013).

Teacher invites students to explore the **New DLO 9 - Risk of accident and effects of alcohol on the human body (infographic)**



They should conclude that risk of accident increases with the increase of BAC level.

Teacher together with students makes the relationship with task performance phases:

- ✓ Collect information: decreased psycho-sensory abilities; poor collection of information; stimulus detection.
- ✓ Anticipation: difficulty in data processing.
- ✓ Decision: difficulties in deciding what to do; bad decisions.
- ✓ Action: longer reaction time; incoordination and suddenness of movements, disturbance of psychomotor abilities.

Teacher should also highlight that drug also deteriorate considerably the task performance while walking, riding or driving.

To consolidate knowledge and deconstruct myths and beliefs associated to alcohol, students will be invited carry out a quiz **New DLO 10 - Alcohol - Myths and Beliefs (Quiz).** Example: Food lessens the effects of alcohol; There are substances that accelerate the elimination of alcohol.

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For further information students are invited to watch the following video: https://etsc.eu/issues/drink-driving/blood-alcohol-content-bac-drink-driving-limits-across-europe/

Supplementary learning resources and educational activities

During the sessions devoted to the development of the research project is organized:

1. **Teleconference with STEM professionals** (e.g., road safety experts, engineers, medical experts, policy makers, public health authorities, officers of the municipality working on traffic management, data scientists or technology developers, researchers of PAFSE consortium).
   Students question experts with a particular focus on: a) future academic choices and career paths; b) identifications of countermeasures to tackle road crashes contributing factors and how to increase safety levels in the local community.
2. **Visits to research centres** (face to face or virtual) – examples in Lisbon: Road Safety National Authority, National Laboratory for Civil Engineering (LNEC), General Directorate for Intervention on Addictive Behaviours and Dependencies (SICAD), Wingdriver
3. **Competition** and reward of best outcome (poster/infographic).

School Research Project

Challenge: plan, design and carry out a data science research project to characterize road safety in the school community

Goal: Analyze self-declared road safety indicators through a survey for risky behaviours concerning road traffic crash risk factors (speed, safety equipment; distraction, fatigue, alcohol, drugs) among school community.

Development process:
The project is based on guided research on road traffic crash risk factors and data obtained through a questionnaire. To address this challenge, students can draw their first ideas about topics to explore from the lessons discussed in the classroom in this scenario and the supplementary educational activities. After understanding the importance of adopting safe behaviours in traffic, students will be invited to brainstorm about how they can contribute to improving road safety levels in the school community and what steps they should follow. With the teacher's support students will conclude that to improve road safety and identify specific road safety countermeasures, they first need to identify and understand the problem.

Students will be invited to explore and identify what are the phases of a research process. They will present and debate their findings and teacher will compare student´s contributions with the **New DLO 11 - Step-by-step questionnaire on road accident risk factors (power BI)** which includes all the information needed for the different phases of the project development:

- ✓ the steps of building a survey.
- ✓ definitions and examples of population, sample, sample size, and associated margin of error.
- ✓ examples of surveys: online forms (if possible, online forms should be used – e.g.: Google Forms, Microsoft Forms, …).
- ✓ a survey based on a crash risk factor (helmet) using a spreadsheet (Microsoft excel, Google sheets, or other) and explains the functions needed for calculating performance indicators based on survey data collected (percentage of cyclists who do not wear the helmet while cycling);
- ✓ discuss the limitations of scientific evidence obtained with the survey.

After exploring the examples and definitions, students are organized in groups. Each group must choose a traffic crash risk factor (speed, distraction, safety equipment, alcohol, etc) and carry out the following tasks:

- ✓ *First task:* select questions about opinions, attitudes and behaviours concerning road traffic crash risk factors exploring the following website https://www.esranet.eu/

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- ✓ *Second task*: define a population, a sample, the sample size, and the associated margin of error. Explain how the margin of error is related to the sample size.
- ✓ *Third task*: build a database using a spreadsheet (Microsoft excel, Google sheets, or other), enter fictitious data into the database, calculate the road safety indicator and the error associated.
- ✓ *Fourth task*: build an app (online form with Microsoft forms, Google forms, or other) for survey data collection

Teacher together with students and supported by the Road traffic Crash risk factors survey (pdf) will complete and close the questionnaire. Teacher should encourage students to include in the questionnaire questions regarding accessibility, disability and equity.
Questions (examples):

- ✓ Over the last 30 days, how often did you, as a car passenger, travel without wearing your seatbelt in the back seat?
- ✓ Over the last 30 days, how often did you, as a cyclist, cycle without a helmet?
- ✓ To what extent do you agree with each of the following statements?
- ✓ I use a mobile phone while driving, because I always want to be available
- ✓ Respecting speed limits is boring or dull.
- ✓ Is the infrastructure around school safe for disable people?

Once the questionnaire is completed, to address opinions, attitudes and behaviours concerning road traffic crash risk factors students and school community are asked to fill the questionnaire.
Based on collected reliable data and real-life cases to propose measures, students will advocate for action that promote safe behaviours in the school community by organizing at school the Road Safety Day where each group will present the research project results by topic through infographics inviting local community, experts, researchers and parents for a broad discussion about how to improve road safety at community level.

During this phase they are invited to explore https://www.roadsafety-dss.eu/#/

"The SafetyCube DSS is the European Road Safety Decision Support System, which has been produced within the European research project SafetyCube, funded within the Horizons 2020 Programme of the European Commission, aiming to support evidence-based policy making. The SafetyCube Decision Support System provides detailed interactive information on a large list of road accident risk factors and related road safety countermeasures."

During the learning process:
1. Students will be able to carry out a data-driven science study through surveying the community.
2. Students will take awareness and analyze quantitative evidence on risky behaviours in traffic and propose policy measures to increase road safety in the community.

Teaching-learning process milestones:
1. Students will be able to incorporate evidence in their poster/infographic coming from a data-driven science study to support their ideas and show media literacy.
2. Students will be able to identify and communicate evidence-based policy measures to help promote road safety in both school and community settings.
3. Students will be able to suggest and advocate for action by different stakeholders, though scientific-based data and information.

Teaching-learning process for school project (summary):
1. Planning: define topics concerning road traffic crash risk factors to include in the project (speed, safety equipment, distraction, fatigue, alcohol, drugs); build the instruments for data collection with the selected indicators; define population, the sample size, and other details of the data collection process.
2. Data collection: carrying out the survey.
3. Data analysis: organizing the data and calculating road safety indicators.
4. Produce posters/infographics with main findings.

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5. Present the poster/infographic in open schooling event.

Organization of the open schooling event:

1. Each project output (poster/infographic) is presented by students in a community setting (e.g., exposition center, municipality, garden, museum, science fair).
2. Students will communicate policy measures using science-based argumentation. Students will appeal to the action of all on behalf of the health and safety of the community, providing great understanding that road safety promotion is a responsibility of all.
3. Students, families, school communities and relevant local stakeholders attend the event and understand how important it is to change behaviour in traffic. They also get high-level understanding on strategies to improve road safety - 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

Report, presentation, poster, or infographic based on science-driven data research.

Target Audience for Recommendations

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

Public Debate and Recommendations (based on research results)

Public presentation of the self-declared road safety indicators 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: Road traffic crash risk factors

Knowledge	
1. Recognizes that road traffic crashes are a leading cause of premature death and pose a significant economic and societal burden.	**Question 1.1.** According to the World Health Organization, what is the leading cause of death for children and young adults aged 5-29 years worldwide? A) road traffic injuries; B) cancer; C) cardiovascular diseases. **Question 1.2.** How many people died in car accidents each year around the world? A) Approximately 1.3 thousand people die each year as a result of road traffic crashes. B) Approximately 3 million people die each year as a result of road traffic crashes. C) Approximately 13 million people die each year as a result of road traffic crashes. **Question 1.3.** How much do road accidents cost? A) Road traffic crashes cost most countries 3% of their gross domestic product B) Road traffic crashes cost most countries 1% of their gross domestic product C) Road traffic crashes cost most countries 0.5% of their gross domestic product
2. Identifies which and how road system elements can contribute to reduce road crashes and the severity of its consequences.	**Question 2.1**. A road system can be intervened to increase road safety. Which elements should be considered? A) Human, environment and vehicle; B) Environment, infrastructure and vehicle; C) Human, vehicle and education. **Question 2.2.** The performance of the 3 road system elements can be improved to reduce the risks of an accident. In which situation? A) Before, during and after the crash; B) During the crash; C) Before the crash.
3. Explains how different risk factors influence task performance and increase the probability of an accident.	**Question 3.1.** A person is walking, riding or driving. Which tasks can be affected by risk factors? A) Collect information, anticipation, decision and action B) Collect information, decision and action C) Collect information, anticipation and action

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3. Recognizes major contributing factors for road traffic injury.	**Question 3.1.** Which of the following conditions increase the risk of a road crash most? A) risky behaviour of the road users (drivers, pedestrians); B) unsafe roads; C) unsafe vehicles (cars, motorcycles, bicycles, …). **Question 3.2.** What is the effect of speeding, driving after drinking alcohol, driving when tired, and using the mobile phone while driving, in the reaction time? A) increase the reaction time; B) reduce the reaction time; C) do not affect the reaction time. **Question 3.3.** How is field of view affected by speed? A) As speed increases, the field of view tends to decrease and the focal length increases B) As speed increases, the field of view tends to increase and the focal length decreases; C) do not affect the field of view **Question 3.4.** Seat belts, airbags and helmets create conditions to: A) Increase the collision time interval and reduce the pressure exerted on passengers; B) Reduce the pressure exerted on passengers C) none of the above **Question 3.5.** What kind of distraction is the most dangerous? A) Cognitive B) Visual C) Manual **Question 3.6.** Which of the following sentences is correct? A) the absorption time of alcohol by the human body is much faster than the elimination time B) the absorption time of alcohol by the human body is much slower than the elimination time C) the absorption time of alcohol by the human body is equal than the elimination time
4. Knows the steps of a data-driven science study. Defines population and sample.	**Question 4.1.** Which of the following options shows the steps of a data-driven science study in a correct order? A) 1º - define the research goal, 2º - collect data, 3º - analyse the data, 4º - draw conclusions; B) 1º - collect data, 2º - analyse the data, 3º - draw conclusions, 4º - define the research goal; C) 1º - define the research goal, 2º - draw conclusions, 3º - collect data, 4º - analyse the data. **Question 4.2.** Which of the following sentences is correct in the context of a statistical study? A) a population is the entire group that a researcher wants to study. A sample is a subset of the population from which the data are collected;

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	B) a sample is the entire group that a researcher wants to study. A population is a subset of the sample from which the data are collected; C) none of the above.
SKILLS	
1. Selects appropriate data sources and indicators to characterize road traffic injuries at different levels (international/national/local).	**Question 1.1.** Which data sources may you use to proper characterize the road safety situation? A) International Institutions such as World Health Organization, European Commission, World Bank; B) Social media publications from unreliable sources; C) Data retrieved by google searches. **Question 1.2.** To find scientific information about road safety I should consult the following sources. A) researchers, scientific publications and national and international experts' institutions. B) friends, journalists, social media; C) google, radio, newspapers.
2. Anticipates the consequences of risky behaviour in traffic.	**2.** What level of risk do you perceive in… 1) low risk... 5) high risk. **Question 2.1.** travel as a car passenger without wearing the seatbelt. **Question 2.2.** as a pedestrian, use the mobile phone while crossing the road. **Question 2.3.** as a pedestrian, cross the road when the pedestrian light is red. **Question 2.4.** as a pedestrian, cross the road outside a crosswalk. **Question 2.5** cycle without a helmet; **Question 2.6.** not respecting the traffic rules while cycling (e.g. don't stop when the traffic light is red or before the "STOP" sign); **Question 2.7.** use the mobile phone while cycling.
3. Rejects unsafe behaviours in traffic.	**3.** **Answer scale:** 1) definitely true... 5) definitively false. **Question 3.1.** I will never use the mobile phone while crossing the road. **Question 3.2.** I will never cross the road when the pedestrian light is red. **Question 3.3.** I will always use the seat belt while travelling as a passenger in a car. **Question 3.4.** I will always use the helmet while cycling. **Question 3.5.** I will never use the mobile phone while cycling.
4. Can identify problems and challenges of the community in relation to road safety.	**Question 4.1.** I feel able to identify the main problems my community faces in relation to road safety. 1) definitely false… 5) definitely true. **Question 4.2.** I feel capable of proposing actions that address road safety challenges in my community. 1) definitely true... 5) definitively false.

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Beliefs, attitudes and behavior	*Include: There are no correct or incorrect answers; we are only interested in knowing your perspective.*
1. Believes that individual choices impact themselves and others' safety.	**1.** **Answer scale:** 1) strongly disagree… 5) strongly agree **Question 1.1.** As a pedestrian, using the mobile phone while crossing the road increases the risk of being run over by a vehicle; **Question 1.2.** As a pedestrian, crossing the road when the pedestrian light is red increases the risk of being run over by a vehicle; **Question 1.3.** As a pedestrian, crossing the road outside a crosswalk increases the risk of being run over by a vehicle; **Question 1.4.** Using the seat belt while travelling in a car may save my life in case of a crash; **Question 1.5.** Cycle with a helmet decreases the risk of serious injuries in case of a crash; **Question 1.6.** Using the mobile phone while cycling is safe; **Question 1.7.** Not respecting the traffic rules while cycling (e.g. don't stop when the traffic light is red or before the "STOP" sign) is dangerous; **Question 1.8.** Driving after drinking alcohol increases de risk of a road traffic crash; **Question 1.9.** Speeding on the road with a car or moped/motorcycle is dangerous; **Question 1.10**. As a driver, pedestrian or passenger, my behaviour has no impact on the safety of others
2. Actively avoids exposure to risk factors.	**2. During the last 30 days, how often have you…?** 1) never… 5) (almost) always (*add option "not applicable"*) **Question 2.1.** travelled as a car passenger without wearing the seatbelt. **Question 2.2.** as a pedestrian, used the mobile phone while crossing the road. **Question 2.3.** as a pedestrian, crossed the road when the pedestrian light was red. **Question 2.4.** as a pedestrian, crossed the road outside a crosswalk, when there was a crosswalk nearby. **Question 2.5.** cycled without a helmet; **Question 2.6.** ignored the traffic rules while cycling (e.g. did not stop when the traffic light was red or before the "STOP" sign); **Question 2.7.** used the mobile phone while cycling.
3. Reproves patterns of risky behaviour in traffic.	**Question 3.1.** The adoption of safe behaviours in traffic will ruin my image 1) strongly disagree… 5) strongly agree **Question 3.2.** For me, the adoption of a safe behaviours in traffic (e.g.: always use the seat belt, not use the mobile phone while crossing the road, always cross the road in the crosswalk, always wear the helmet while cycling) in the next 3 months, would be: 1) bad... 5) good **Question 3.3.** For me, to adopt safe behaviours in traffic, in the next three months, would be: 1) useless... 5) useful

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	Question 3.4. I don't accept patterns of risky behaviours in traffic even if I'm with my family and friends. 1) definitely true... 5) definitively false.
4. Is committed to reduce the health and societal burden of road traffic accidents.	**Question 4.1.** I intend to identify problems of my community in relation to road safety in the next three months. 1) extremely unlikely... 5) extremely likely **Question 4.2.** I intend to address the challenges of my community in relation to road safety in the next three months. 1) extremely unlikely... 5) extremely likely **Question 4.3.** Among the following statements, choose the one that best describes what you currently think. 1) I am not contributing to the road safety of my community, and I also have no intention of doing so; 2) I am not contributing the road safety of 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 the road safety of my community, but soon I will start doing it on a regular basis; 4) I am contributing to the road safety of my community regularly; 5) For more than six months I have always or almost always been contributing to the road safety of my community; 6) For several years now, I have been contributing to the road safety of my community, and I will continue to do so.
5. Attitude towards safe behaviours in traffic	**Question 5.** For me to adopt safe behaviours in traffic is: **5.1**. harmful :_____:_____:_____:_____:_____: beneficial **5.2**. pleasant :_____:_____:_____:_____:_____: unpleasant **5.3**. good :_____:_____:_____:_____:_____: bad **5.4**. worthless :_____:_____:_____:_____:_____: valuable **5.5**. enjoyable :_____:_____:_____:_____:_____: unenjoyable

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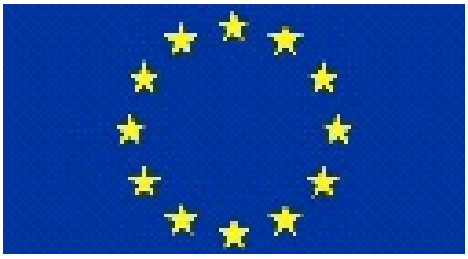

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