LIVING STEM

AGE : 13 - 14

Design an eco-sustainable city

Project number: KA201-050529

Activity n°2

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Générations.bio LogoPsyCom The Polish Farm Advisory and Training Centre EDUlab ed consult CITIZENS IN POWER Tràsit Projectes

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Educator's guide

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Introduction

In this activity, students are called to design an eco-sustainable city, taking into account all the aspects of real life that they can identify. Students will describe their vision of a sustainable city, identify the challenges that cities face and discover the ecosystem services provided by nature.

Calendar

This activity takes place in the classroom and can therefore be carried out at any time of the year.

Duration

6 hours divided in different sessions
Task 1: 1 hour
Task 2: 1 hour
Task 3: 2 hours
Task 3: 2 hours

Gamification method(s)

- Role play
- Design Thinking
- Questioning

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Preparation

The main role of the teacher in this activity is that of the facilitator.
For each task, the teacher must first introduce the objective (observe, analyse the data, define the problem, etc.). Then he/she must share the rules to achieve the task goal. The rules may vary according to the class but the logic of cooperation is always preferred.
The third step is to provide useful tools to successfully complete the task (guide questions, analysis sheets, data tables, etc.)
Finally, the teacher must observe that the activity is conducted correctly and on time.

Usefull worksheets for each task

- List of elements not immediately evident to identify on the city map.
- List of open sources where to find useful data (websites, books, publications of the municipality, etc.).
- List of mathematical and geometric formulas useful for defining problems in numerical form.
- In general, it may also be useful to have a list of guiding questions to use if needed.

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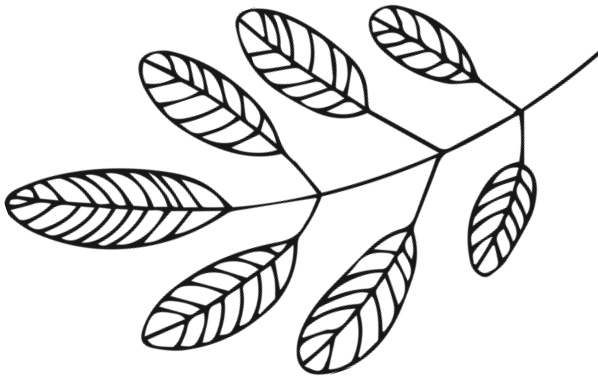
Challenges that will lead to the completion of the main task:

A challenge can be made for each task. The four challenges are based on the speed of identifying the problem, the originality of the solution and the accuracy of the calculations. You can also reward ideas that emphasize more the ethical aspects of solutions, citizens' activism, attention to the care of the planet.
It is recommended to use the students as a popular jury to which the teacher is added with the role of a technical jury.

Tips for successful facilitation, supervision and organizing:

A useful tip is to have a predefined set of questions that help identify problems. Another useful tip is to have a set of issues to deal with in solving problems. Finally, it is appropriate to have a list of formulas useful for calculating the impact of individual problems. In this way, no activity risks stalling.
In supervision, it is important to monitor the activity of individual students within the group, avoiding that some participate less than others.



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Debriefing outcomes & obtained competences:

The activity debrief must cover both the theoretical and practical aspects addressed, referring in particular to the comparison between the data on the city before and after. Furthermore, it will be important to underline the role that the individual can play in improving city life when deciding to change habits.

The activity improves the level of competence of the practical application of mathematical knowledge. It also introduces basic design and engineering design skills.
The output of the activity is a map of an eco-sustainable city that is not imaginary but based on life experiences in one's own city.

Impact on external stakeholders

The result of the teaching activity, i.e. a map of an eco-sustainable city, can be shared with the local community. In particular, the point of view of young people regarding how a city is organized and managed can be made public. If there are youth civic committees or small children's parliaments in the municipality, the proposal can be discussed in public. Local newspapers, online or in print, may also be interested in talking about the results of the teaching activity.

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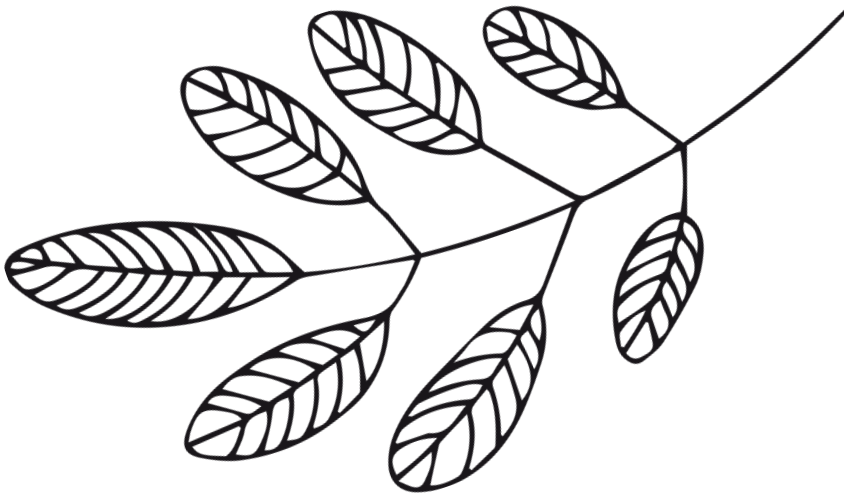
Moment of formal education (optional)

Stimulate a debate around this topic: Sustainable cities are much more than places where humans and nature coexist productively; they are cities in which all people—regardless of race, colour, income, and so on—have equal access to a healthy environment in which they can flourish.



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Students' worksheet

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Related STE(A)M theory:

Engineering and Technology
Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

Design and Technology
Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

Production and Processing
Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

Mathematics
Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Biology
Knowledge of plant and animal organisms and their tissues, cells, functions, interdependencies, and interactions with each other and the environment.

Systems Analysis and Evaluation, Quality Control Analysis
Determining how a system should work and how changes in conditions, and the environment will affect outcomes, identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system

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Key words

Design, urban planning, economic activities, green areas, areas for animals, public transport, energy sources, sustainability.

Educational Objective(s)

Curiosity
Students will increase interest towards the environment and develop self-directed initiative for exploration and searching of information
Objectivity
Students will be able to record data as observed, not affected by feelings, imagination and explain observations rationally
Cooperation
Students will be able to work together in carrying out activities and experiments.
Ethical decision-making
Students will be able to evaluate and choose among alternatives in a manner consistent with ethical principles.

Suggested Environmental Context

This activity can be carried out independently by a teacher with technology skills. However, it is advisable to activate a partnership with the local authorities, for example the municipal authorities, which are responsible for transport, public green areas, the distribution of water or electricity or for the collection and disposal of waste.

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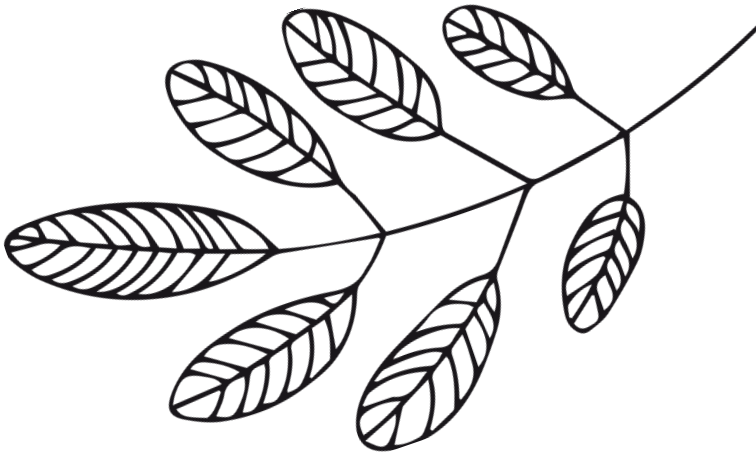
Necessary Equipment and Materials:

The necessary tools are large sheets, pencils, crayons, rulers, squares, compasses and notepads for notes. An electronic whiteboard can be very useful.
Eventually, materials of different nature can be made available to children to enrich the experience of a tactile component. In particular, soil and sand that connect to green and play areas, wood and brick that are connected to construction, plastic, glass, paper and others that are connected to waste disposal.

Media and Resources

- Google Earth and Google Maps
- Inspirational videos like this

https://www.pbslearningmedia.org/resource/nature-works-everywheresustainable-cities-clip/nature-works-everywhere-sustainable-cities-clip/#.W04RCi3MzGI



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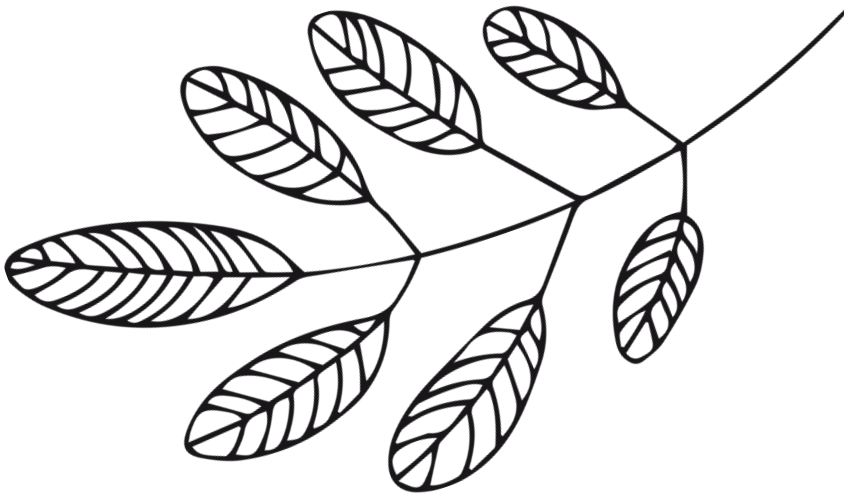
Tasks

1 Observation and classification

By observing a map of their city the students highlight the green areas, the natural water supplies, the production sites, the school and public buildings, the main communication routes, the shopping streets, the shopping centres, the waste disposal sites.
For each type, clearly visible labels are placed on the map and the borders of the different areas are highlighted. If there are doubts in the classification of an area or activity, students must find an agreement through the debate.
If an electronic whiteboard is available, students can view the city map digitally using Google maps. While for further information you can use Google Earth.

2 Data analysis

Students analyse the available data relating to the number of inhabitants, the number of inhabitants per square kilometre, the average age of the population, the number of public transport lines and the data available on the economic activities of the city. In addition, standard data such as emissions from different types of public and private transports or data on the absorption of smog by trees and green areas are analysed.



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Tasks

3 Problem definition

In this phase, students must define a list of problems that emerge from observing the city map with labels and borders, making use of the data available to them.
The problems must be clearly described with a narrative style (storytelling) and supported by the data. All the calculations useful to highlight the problems must be carried out. And if possible, estimates should also be made about the future that give rise to graphs and tables.
Students must also refer to their practical experience, taking note, for example, of the time it takes to get to school and to go to sports centres, the number of transport vehicles they use in order to also reflect on their ecological footprint.
It is also important to determine if some problems occur mostly in some areas of the city, which need to be specifically classified on the map.

4 Problem solving

Using creativity and scientific and technological knowledge, students must find solutions to the problems listed. After solving the urgent problems, structural improvements that impact the entire city can also be assumed.
This activity can be done in subgroups.
Starting from the city map enriched with all information (labels, borders, problem areas), students must redesign a city where major problems are solved. It is clearly a simplified city map similar to a new urbanization project.
A new set of calculations must be done to verify that the problems are actually resolved.

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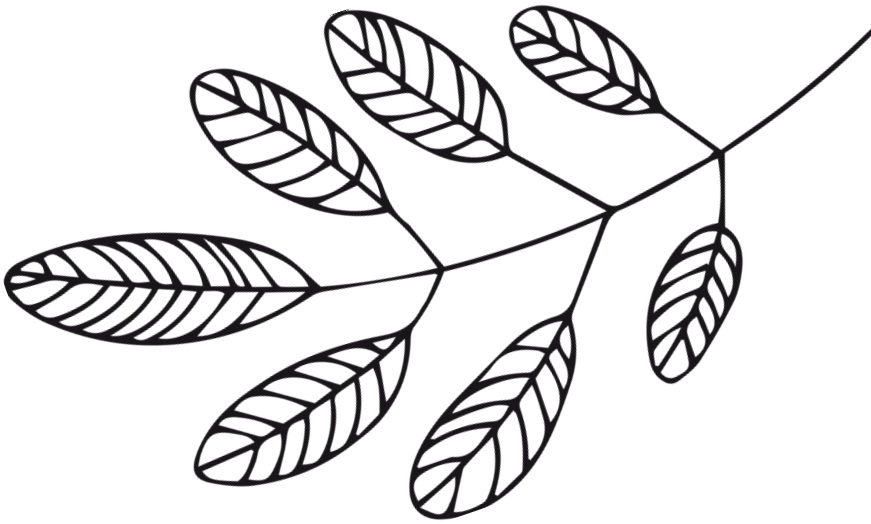
Safe and security checklist

This activity does not require special attention to the security issue. However, it is advisable to carry out the activity of sharing the work tools which are pencils, squares, compasses, ruler and glue.

(Note: This should be in alignment with safe and security checklist, given within The LivingSTEM Manual, Chapter 8)



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