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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 1
STUDENT TEACHERS: Urban heat effect - extended

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1. Overview

Title	Urban heat effect
Driving Question or Topic	*Due to climate change the temperatures in cities will increase even more, so we must act to tackle this*
Ages, Grades, …	*Age selection 17-18* *K-12 grade level selection*
Duration, Timeline, Activities	*Min 14 hours* *Max 20 hours* *Always lesson blocks of 2 lessons (2 x 45-50 min)* *This project can be adjusted according the time and involved subjects*
Curriculum Alignment	Climate change, calculations, data handing, web search,
Contributors, Partners	*EUROGEO*
Abstract - Synopsis	*A study comparing urban to rural temperatures to understand the health and mortality effects of extreme heat, alongside examining how energy transformation and radiation impact different building materials. It also considers the role of green spaces and water in cities for climate resilience, with a focus on sustainable development and a cost-benefit analysis of such environmental strategies.*
References, Acknowledgements	https://education.nationalgeographic.org/resource/urban-heat-island/ https://climate.copernicus.eu/demonstrating-heat-stress-european-cities https://www.sciencedirect.com/topics/engineering/urban-heat-island-effect

2. STEAME ACADEMY Framework*

Teachers' Cooperation	***Teachers geography:*** ● *via remote sensing analysing the temperature in cities – compared with the country side (geography)* ***Teacher biology, geography, informatics:*** ● *investigate the consequences for extreme heat on health and excess mortality* ***Teacher biology, physics, chemistry:***

	• *investigate and explain impact of radiation on different materials (concrete, stone, wood …)* • *investigate and explain the role of green in the city (trees, herbs, grass) & the role of water* ***Teacher technology & art:*** • *create / modify an existing (area of) city to make it more climate resilient - implementing green & blue in the city - taking into consideration the sustainability of your efforts* ***Teacher economics:*** • *calculate the costs/benefits of these impacts*
STEAME in Life (SiL) Organization	*Meeting with municipalities, local organisations …* *public & private*
Action Plan Formulation	*Reference to the Stages and the Steps of the STEAME ACADEMY Framework for Project-based STEAME learning (Action Plan Formulation)* *Step 1: Theoretical background knowledge* • *Understand the basic principles of urban heat islands: analyse temperatures in the city compared with the countryside to establish a foundational understanding of the differences.* • *Grasp the concepts of how energy is transformed into heat within urban environments and the impacts of various types of radiation on different building materials such as concrete, stone, and wood.* *Step 2: Extension of theoretical knowledge* • *Extend knowledge on urban heat by investigating the consequences of extreme heat on health and excess mortality, linking temperature variations with public health outcomes.* • *Deepen understanding of the heat generation process, exploring how energy transformation causes heat and how radiation affects different urban materials, which influences the city's overall temperature.* *Step 3: Formulation and definition of the project* • *Formulate a clear objective for the project: to create or modify an existing urban area to enhance climate resilience.* • *Define specific strategies for incorporating greenery and water features in the city, considering the role of green (trees, herbs, grass) and blue (water bodies) infrastructure.* *Step 4: Application of knowledge* • *Implement the theoretical knowledge and strategies into a practical urban design plan.* • *Modify an existing area of the city, or create a new design that integrates green and blue spaces effectively, aiming for climate resilience and sustainability.* *Step 5: Evaluation*

	• *Calculate the costs and benefits of the implemented climate resilience strategies, considering both monetary and non-monetary factors such as improved health outcomes and ecosystem services.* • *Assess the sustainability of the efforts, ensuring that the climate resilience measures are durable, cost-effective, and provide long-term benefits to the urban population.*

[*] *under development the final elements of the framework*

3. Objectives and Methodologies

Learning Goals and Objectives	*After completing the project, students should* *- know the basic principles of urban heat islands* *- understand the concepts of energy transition* *- know the principles to make a city more climate resilient* *- understand the importance of green and blue in a city* *- be able to calculate costs and benefits of the applied strategies*
Learning Outcomes and expected Results	*After completing the project students should:* **Knowledge** • *Know the basic principles of the heat island* • *Know how to make a city more climate resilient* • *understand energy transition (physics)* • *understand photosynthesis (biology)* • *know the principles of remote sensing (geography)* **Skills** - *Perform satellite analysis* - *Use GIS* - *Perform mathematical calculations (average, range)* - *Better use of spreadsheet and presentation software* - *Better communication and presentation skills* - *Artistical creativity* **Attitudes** - *develop the interest about climate in cities* - *develop interest in strategies to make cities climate resilient* - *develop interest in STEAME*
Prior Knowledge and Prerequisites	**Prior knowledge - skills:** - *Basic mathematical calculations* - *Basic knowledge of environment (biology)* - *Basic knowledge of physiscs* - *Basic use of office applications suite (Microsoft Office, Libre office or equivalent)* - *Basic use of GIS* - *Working in teams* - *Communication and cooperation skills* **Prerequisites:** - Laboratory with access to the web - Office suite (presentations, spreadsheets) - GIS tools - Field work

	- Teleconference platform - Presentation equipment (projector/presentation screen)
Motivation,	**Motivation** - *Climate change and the impact on cities discourse* - *Project results that can be applied in local context*
Methodology,	**Methodology** *Project based approach that presupposes the collaboration between teachers of science, maths and IT and the team work of the students in the project of local weather.*
Strategies, Scaffolds	**Strategies** *Project based learning.* *Work in small teams.* *Guided discovery* *Autonomous work* **Scaffolds** *Guidance and consultancy* *Additional information sources* *Computer laboratory access and support* *Collaborative development of products and evaluation methods*

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	*The teacher mainly in charge of the project is the Geography Teacher.* *The Geography teacher discusses with the other teachers the goals and the concept of the project and the implementation steps. He/She accesses initially the sources of information and together with the other teachers set the timeframe of their intervention. He/She prepares a project presentation sheet containing also the information from the other teachers. They all have a preliminary access to the information sources. All the teachers together decide on the timeframe of implementation of the project.* *This project can be done extended (all subjects of STEAME involved) or limited (only science teachers involved)* *Depending of how much time is available and how many subject will be involved the timeframe will shorter or longer.* *For the realization of the project students work in their classroom and in the computer laboratory, and also perform field work* *In the extended version (also including Art and Engineering) a technology work place is needed*
Resources, Tools, Material, Attachments, Equipment	**Classroom** *A computer with access to the internet, office applications and teleconferencing applications is needed and presentation equipment for the presentation of new concepts, the presentation of the students works and the communication with the external actors.* **Computer laboratory** *In the laboratory students will work in teams for the access to online resources and for the collection, analysis and presentation of the data. Therefore*

	computers with access to the internet and office applications installed are needed. **Technology work place** *If engineering and art is also involved students will need a place to develop their models*
Health and Safety	*There are no particular health and safety concerns or precautions as the project is implemented inside the school unit.*

5. Implementation

Instructional Activities, Procedures, Reflections	*This plan is developed under the assumption that it extents to min 14 study hours based on each time 2 lesson blocks (so 90-100 minute lessons). Classes are held once a week in the context of additional activities in secondary education. The leading teacher (Geography teacher -T1) is involved in all lessons, the teacher of biology (T2), physics (T2), informatics (T3), mathematics (T4), art (T5), engineering (T6) and economics (T7) are involved in specific project stage and during implementation following the organization and scheduling of the project.* *Lesson block 1* *T1* *25 minutes presentation of the project to the students* *- reasing motivation* *- definition of project* *- presentation of collaboration* *T1, T2, T3* *Learning stations on* ● *understand energy transition (physics)* ● *understand photosynthesis (biology)* ● *know the principles of remote sensing (geography)* *Lesson block 2* *T1, T3* *Using remote sensing analyses of the urban heat effect in a local city* *T1, T5* *Statistics on excess mortality due to the urban heat effect* *Lesson block 3* *T1, T2, T3* *Field observation of the local city – linking to analysis results done via remote sensing* *Measuring effects of materials and green & blue in the city* *Lesson block 4* *T1, T2, T3, T4* *Studying measures to tackle the urban heat effect* *Create alternatives & solutions for using a.o. green en blue techniques* *Lesson Block 5 (in case 14 h) or 5 – 8 (in case 20 h)* *T1, T4 T5, T6* *Using software students will create a computer model of their solutions, and if possible create a real model*

	Lesson Block 6 (14 h) or 9 (20 h) *T1, T4, T7* *Using real prices of products students will calculate the cost of their proposed model.* *Finally they will make a presentation* *Lesson block 7 (14 h) or 10 (20 h)* *Presentation of the results of the different groups to the teachers & city council* *Peer evaluation* *General evaluation & feedback*
Assessment - Evaluation	*Evaluation is based on the final product of the students and is carried out by the teachers, the students of the other team & city council*
Presentation - Reporting - Sharing	*The final result of the project is presented to the teachers and the students of the other team and the city council.* *Other participants, like students from another classes, parents and general public can also be present.*
Extensions - Other Information	

STEAME ACADEMY Prototype/Guide for Learning & Creativity Approach
Action Plan Formulation

Major steps in the STEAME learning approach:

STAGE I: Preparation by one or more teachers

1. Formulating initial thoughts on the thematic sectors/areas to be covered
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.

STAGE II: Action Plan Formulation (Steps 1-18)

Preparation (by teachers)

1. Relation to the Real World – Reflection
2. Incentive – Motivation
3. Formulation of a problem (possibly in stages or phases) resulting from the above

Development (by students) – Guidance & Evaluation (in 9-11, by teachers)

4. Background Creation - Search / Gather Information
5. Simplify the issue - Configure the problem with a limited number of requirements
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
8. Observation-Experimentation - Initial Conclusions
9. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
10. Gathering of results / information based on points 7, 8, 9
11. First group presentation by students

Configuration & Results (by students) – Guidance & Evaluation (by teachers)

12. Configure STEAME models to describe / represent / illustrate the results
13. Studying the results in 9 and drawing conclusions, using 12
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)

Review (by teachers)

15. Review the problem and review it under more demanding conditions

Project Completion (by students) – Guidance & Evaluation (by teachers)

16. Repeat steps 5 through 11 with additional or new requirements as formulated in 15
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions

18. Presentation of Conclusions - Communication Tactics.

STAGE III: STEAME ACADEMY Actions and Cooperation in Creative Projects for school students

Title of Project: Urban heat effect - extended
Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1(T1) Cooperation with other teachers and student guidance	**Activities /Steps** **By Students** Age Group: 17-18 y
A	Preparation of steps 1,2,3, 4, 5	
B	Guidance and support in steps 4-10	Steps 4-10
C	Creative Evaluation	11
D	Guidance and support	12
E	Guidance and support	13 (9+12)
F	Organization (SIL) STEAME in Life	14 Field work & meeting with local council
G	Preparation of step 15	
H	Guidance and support	16 (repetition 5-11)
I	Guidance and support	17
K	Creative Evaluation	18