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STEAME ACADEMY

TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2

STUDENT TEACHERS: **Gulf Stream drops - extended**

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1. Overview

Title	Urban heat effect
Driving Question or Topic	<i>How does the dropping Gulf Stream affect climate change, and what are the potential global consequences?</i>
Ages, Grades, ...	Age selection 17-18 K-12 grade level selection
Duration, Timeline, Activities	Minimum 14 hours - Maximum 20 hours Always lesson blocks of 2 lessons (2 x 45-50 min)
Curriculum Alignment	Oceanography, climate science, data handling, web search,
Contributors, Partners	EUROGEO
Abstract - Synopsis	<i>A study examining the potential effects of the weakening Gulf Stream on global climate patterns, focusing on the potential for more extreme weather events, changes in sea level, and shifts in marine ecosystems. The project also explores mitigation strategies and the importance of international cooperation in addressing these issues.</i>
References, Acknowledgements	https://blog.education.nationalgeographic.org/2018/04/16/sluggish-gulf-stream-reaches-slowest-rate-in-more-than-1000-years/ https://ocean.weather.gov/gulf_stream.php https://www.ncei.noaa.gov/news/gulf-stream-resilience https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ocean-currents

2. STEAME ACADEMY Framework*

Teachers' Cooperation	<p>Teachers geography:</p> <ul style="list-style-type: none"> analysis of Gulf Stream patterns and global ocean currents. <p>Teacher biology, geography, informatics:</p> <ul style="list-style-type: none"> investigate the impact on marine ecosystems and biodiversity. <p>Teacher physics</p> <ul style="list-style-type: none"> investigate Oceanic and atmospheric dynamics <p>Teacher chemistry</p>
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	<ul style="list-style-type: none"> investigate changes in salinity <p>Teacher informatics, geography</p> <ul style="list-style-type: none"> data analysis and visualization using GIS tools <p>Technology & Art Teacher:</p> <ul style="list-style-type: none"> Development of models and visual representations. <p>Economics Teacher:</p> <ul style="list-style-type: none"> Cost-benefit analysis of proposed mitigation strategies.
STEAME in Life (SiL) Organization	Meeting with environmental organizations, local councils, and public & private sectors.
Action Plan Formulation	<p><i>Reference to the Stages and the Steps of the STEAME ACADEMY Framework for Project-based STEAME learning (Action Plan Formulation)</i></p> <p>Step 1: Theoretical background knowledge</p> <ul style="list-style-type: none"> Understand the basic principles of the Gulf Stream and its role in global climate. Grasp the concepts of oceanic and atmospheric dynamics affecting the Gulf Stream. <p>Step 2: Extension of theoretical knowledge</p> <ul style="list-style-type: none"> Investigate the potential impacts of a weakening Gulf Stream on climate patterns and marine ecosystems. Deepen understanding of the physical and chemical changes in the ocean <p>Step 3: Formulation and definition of the project</p> <ul style="list-style-type: none"> Formulate clear objectives: Assess and propose mitigation strategies for the impacts of the weakening Gulf Stream. Define specific strategies for raising awareness and promoting international cooperation. <p>Step 4: Application of knowledge</p> <ul style="list-style-type: none"> Implement the theoretical knowledge and strategies into into a practical mitigation and awareness plan. Develop detailed strategies for research, data collection, and community engagement. <p>Step 5: Evaluation</p> <ul style="list-style-type: none"> 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	<p><i>After completing the project, students should</i></p> <ul style="list-style-type: none"> Know the basic principles of the Gulf Stream and its role in climate regulation. Understand the potential impacts of its weakening. Know the principles of oceanic and atmospheric dynamics.

Learning Outcomes and expected Results	<ul style="list-style-type: none"> ● <i>Understand the importance of international cooperation in climate change mitigation.</i> ● <i>Be able to calculate costs and benefits of applied strategies.</i> <p><i>After completing the project students should:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> ● <i>Know the basic principles of the Gulf Stream.</i> ● <i>Understand the potential impacts on global climate and marine ecosystems.</i> ● <i>Know how to use GIS tools for data analysis.</i> <p>Skills</p> <ul style="list-style-type: none"> - <i>Perform satellite analysis.</i> - <i>Use GIS for data visualization.</i> - <i>Conduct mathematical calculations (average, range).</i> - <i>Improve presentation and communication skills.</i> - <i>Develop artistic creativity.</i> <p>Attitudes</p> <ul style="list-style-type: none"> - <i>Develop an interest in oceanography and climate science.</i> - <i>Foster a sense of responsibility towards climate change mitigation.</i> - <i>develop interest in STEAME</i>
Prior Knowledge and Prerequisites	<p>Prior knowledge - skills:</p> <ul style="list-style-type: none"> ● <i>Basic mathematical calculations</i> ● <i>Basic knowledge of environment (biology)</i> ● <i>Basic knowledge of physics</i> ● <i>Basic use of office applications suite (Microsoft Office, Libre office or equivalent)</i> ● <i>Basic use of GIS</i> ● <i>Working in teams</i> ● <i>Communication and cooperation skills</i> <p>Prerequisites:</p> <ul style="list-style-type: none"> ● <i>Laboratory with access to the web</i> ● <i>Office suite (presentations, spreadsheets)</i> ● <i>GIS tools</i> ● <i>Field work</i> ● <i>Teleconference platform</i> ● <i>Presentation equipment (projector/presentation screen)</i>
Motivation, Methodology, Strategies, Scaffolds	<p>Motivation</p> <ul style="list-style-type: none"> ● <i>Discussion on climate change and its global impacts.</i> ● <i>Real-world application of project results.</i> <p>Methodology</p> <p><i>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.</i></p> <p>Strategies</p> <p><i>Project based learning.</i></p> <p><i>Work in small teams.</i></p>

Guided discovery
Autonomous work

Scaffolds

Guidance and consultancy
Additional information sources
Computer laboratory access and support
Collaborative development of products and evaluation methods

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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 involves all science teachers + math and informatics teacher + technology, art and economics teachers. 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

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.

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 10 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 (T3), informatics (T4), mathematics (T5), Art (T6), Engineering (T7), and Economics (T8) 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
 - ocean currents
 - marine ecosystems
 - atmospheric dynamics

Lesson block 2

T1, T3

Using remote sensing analyses of Gulf Stream patterns

T1, T5

Statistics on climate impacts due to Gulf Stream changes

Lesson block 3

T1, T2, T3

Field observation linking to remote sensing analysis results

Lesson block 4

T1, T2, T3, T4

Studying mitigation measures, creating alternatives and solutions

Lesson block 5-8

T1, T4, T5, T6

Using software to create computer models of solutions and, if possible, develop real models

Lesson Block 9

T1, T4, T7:

Using real prices of products, calculate the cost of proposed models and prepare final presentations

Lesson Block 10:

Presentation of the results of the different groups to the teachers

Peer evaluation

General evaluation & feedback

Assessment - Evaluation

Evaluation is based on the final product of the students and is carried out by the teachers and the students of the other team

Presentation - Reporting - Sharing

The final result of the project is presented to the teachers and the students of the other team. Other participants, like students from another class can also be present.

Extensions - Other Information

See version Level 2

Detailed Lesson Blocks for “Climate Change Due to the Dropping Gulf Stream”

Lesson Block 1

Duration: 90-100 minutes

Activities:

- **Project Introduction (T1):** 25 minutes
 - **Content:** Introduction to the project, including the importance of the Gulf Stream, its role in climate regulation, and the potential impacts of its weakening.
 - **Method:** Presentation and discussion.
 - **Materials:** PowerPoint slides, educational videos, and introductory reading materials.
- **Learning Stations (T1, T2, T3):** 60-75 minutes
 - **Station 1 (Physics - T3):** Understanding Ocean Currents
 - **Content:** Explanation of ocean currents, how the Gulf Stream operates, and its impact on global climate.
 - **Method:** Interactive lecture and demonstrations.
 - **Materials:** Diagrams, animations, and hands-on activities (e.g., water tanks to simulate currents).
 - **Station 2 (Biology - T2):** Marine Ecosystems
 - **Content:** Impact of the Gulf Stream on marine biodiversity and ecosystems.
 - **Method:** Group discussion and case study analysis.
 - **Materials:** Research papers, case studies, and multimedia resources.
 - **Station 3 (Geography - T1):** Remote Sensing Principles
 - **Content:** Basics of remote sensing and its application in studying ocean currents.
 - **Method:** Practical demonstration and guided practice.
 - **Materials:** GIS software, remote sensing imagery, and tutorial guides.

Expected Outcomes:

- Students will have a basic understanding of the Gulf Stream and its significance.
- Students will be introduced to the principles of ocean currents, marine ecosystems, and remote sensing.

Lesson Block 2

Duration: 90-100 minutes

Activities:

- **Remote Sensing Analysis (T1, T3):** 45-50 minutes
 - **Content:** Using GIS and remote sensing tools to analyze Gulf Stream patterns.
 - **Method:** Hands-on computer lab session.
 - **Materials:** Computers with GIS software, remote sensing data, and analysis guides.
- **Statistical Analysis (T1, T5):** 45-50 minutes
 - **Content:** Statistics on climate impacts due to changes in the Gulf Stream, focusing on data interpretation and visualizations

- **Method:** Interactive lecture and practical exercises.
- **Materials:** Datasets, statistical software (e.g., Excel, R), and visualization tools.

Expected Outcomes:

- Students will gain practical experience in using remote sensing and GIS tools.
- Students will learn to analyze and interpret statistical data related to climate impacts.

Lesson Block 3

Duration: 90-100 minutes

Activities:

- **Field Observation (T1, T2, T3):** 90-100 minutes
 - **Content:** Conducting field observations to link remote sensing data with real-world conditions.
 - **Method:** Field trip to a local coastal area or a virtual field trip if physical visit is not possible.
 - **Materials:** Field notebooks, data collection tools (e.g., thermometers, salinity meters), and virtual field trip software.

Expected Outcomes:

- Students will connect theoretical knowledge with practical field observations.
- Students will enhance their data collection and analysis skills in real-world settings.

Lesson Block 4

Duration: 90-100 minutes

Activities:

- **Mitigation Measures Study (T1, T2, T3, T4):** 90-100 minutes
 - **Content:** Studying various mitigation measures to counteract the impacts of the weakening Gulf Stream.
 - **Method:** Group research and presentations
 - **Materials:** Research articles, case studies, and multimedia resources.

Expected Outcomes:

- Students will understand various mitigation strategies.
- Students will improve their research and presentation skills.

Lesson Block 5

Duration: 90-100 minutes

Activities:

- **Software Modeling (T1, T4, T5, T6):** 90-100 minutes
 - **Content:** Using modeling software to create digital representations of proposed solutions.
 - **Method:** Computer lab session with guided instruction.
 - **Materials:** Modeling software (e.g., CAD, GIS), computers, and project guidelines.

Expected Outcomes:

- Students will develop digital models of their proposed mitigation strategies.

- Students will enhance their technical skills in software modeling.

Lesson Block 6

Duration: 90-100 minutes

Activities:

- **Cost Calculation (T1, T4, T7):** 45-50 minutes
 - **Content:** Calculating the costs of proposed models using real product prices.
 - **Method:** Spreadsheet exercises and guided calculations.
 - **Materials:** Price lists, spreadsheets (e.g., Excel), and cost calculation templates.
- **Final Presentation Preparation (T1, T4, T7):** 45-50 minutes
 - **Content:** Preparing final presentations for project results.
 - **Method:** Group work and teacher feedback sessions.
 - **Materials:** Presentation software (e.g., PowerPoint), projectors, and feedback forms.

Expected Outcomes:

- Students will be able to calculate the costs of their proposed solutions.
- Students will develop professional presentation skills.

Lesson Block 7

Duration: 90-100 minutes

Activities:

- **Final Presentations and Peer Evaluation (T1, T4, T7, City Council):** 90-100 minutes
 - **Content:** Presentation of project results to teachers, peers, and city council representatives.
 - **Method:** Formal presentations and peer evaluations.
 - **Materials:** Presentation equipment, evaluation rubrics, and feedback forms.

Expected Outcomes:

- Students will gain experience in presenting their work to an audience.
- Students will receive constructive feedback for future improvements.

Lesson Block 8 (Optional for 20-hour version)

Duration: 90-100 minutes

Activities:

- **Extended Analysis and Refinement (T1, T4, T6):** 90-100 minutes
 - **Content:** Further refinement and detailed analysis of proposed solutions based on feedback.
 - **Method:** Group work and individual research.
 - **Materials:** Research tools, feedback forms, and analysis software.

Expected Outcomes:

- Students will refine their projects based on received feedback.
- Students will develop deeper insights into their proposed solutions.

Lesson Block 9 (Optional for 20-hour version)

Duration: 90-100 minutes

Activities:

- **Advanced Modeling and Simulation (T1, T4, T6):** 90-100 minutes
 - **Content:** Advanced modeling and simulation of refined solutions.
 - **Method:** Computer lab session with advanced software tools.
 - **Materials:** Advanced modeling software, computers, and simulation guides.

Expected Outcomes:

- Students will enhance their modeling and simulation skills.
- Students will produce high-quality digital models of their solutions.

Lesson Block 10 (Optional for 20-hour version)

Duration: 90-100 minutes

Activities:

- **Final Review and Presentation (T1, T4, T7, City Council):** 90-100 minutes
 - **Content:** Final review of projects and presentation to teachers, peers, city council, and community members.
 - **Method:** Formal presentation and comprehensive evaluation.
 - **Materials:** Presentation equipment, evaluation rubrics, and community feedback forms.

Expected Outcomes:

- Students will successfully present their final projects to a broader audience.
- Students will gain valuable experience in public speaking and project evaluation.

Resources for the development of the STEAME ACADEMY Learning and Creativity Plan Template

In the case of learning through project-based activity

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

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

Title of Project: Urban heat effect - lite

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