Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) – LEVEL 1 STUDENT TEACHERS:
Handling Data in the Context of Climate Change

S	T	Eng	A	M	Ent
●	●			●	

L1 Teachers

In the case of learners/ student teachers the L&C plan that follows should be a document for study and exchange of ideas both among themselves as well as with the trainer. A fruitful approach would be, if possible one where experienced/ service teachers are involved as well either in some of the roles of the teachers that are mentioned in the section on the cooperating teachers that follows. In this framework the L&C plan should be the object of consideration and discussion between the trainer and the trainees so that the following aspects would be the object of enrichment at each step of the study and experimental implementation, if possible, by the trainees:

Provide further opportunities in dealing with the subject matter (e.g. Give them further resources in the area, enrich with a variety of skills with teaching approaches)

Enrich with ideas for classroom management (e.g. inclusive classroom approaches, flipped classroom activities, PBL methodology)

Focus on practical teaching skills (e.g. lesson planning, assessment strategies)

Discuss on Connecting to real world experience.

Emphasize the need for reflection, communication and discussion/ debate

1. Overview

Title	Handling Data in the Context of Climate Change
Driving Question or Topic	• What are the key concepts and skills that students should learn about handling data in the context of climate change? • What are the different types of data that students should be able to collect, analyze, and interpret? • How can students use data to understand the impact of climate change on different regions, ecosystems, and communities? • What are some real-world examples of how data has been used to address climate change? • How can students use data to develop and communicate solutions to mitigate the effects of climate change?

	• How do we represent data on the topic? • What statistical methods are appropriate for the analysis of climate data and how can we analyze them to identify trends, patterns, and anomalies related to climate change? • What areas of the realms of meaning are involved in the process of understanding and managing climate change data? • What technology tools and platforms can enhance our ability to handle and visualize climate change data? • How can we leverage digital resources and simulations to make the learning experience more interactive? • What is involved in the process of handling data? • What assessment methods can be used to evaluate students' understanding of both data handling skills and climate change concepts and how do we incorporate these in the learning process? • What actions can students take based on their understanding of climate change data, as a process for reflection and consideration on the impact of data on climate change ?
Ages, Grades, … Duration, Timeline, Activities	**16-18 years old** **Grades 10-12** **10 learning hours** **4-5 Number of activities**
Curriculum Alignment	The above questions imply that the whole approach concerns mainly Geography and Social Studies, Biology, Chemistry, Mathematics. Furthermore, the reflection on the issues and the interpretation of the outcomes requires consideration of the issue in every topic of the realms of meaning
Contributors, Partners	*In the context of the consideration of this topic and taking in mind the driving questions, it is going to be useful to include the cooperation of a number of experts/ teachers covering a broad spectrum of the realms of meaning. Thus, it is suggested to involve a Geography teacher (T1), a Science teacher (T2) and a Mathematics teacher(T3). Furthermore, it is going to be useful to come in contact with experts in the field that are involved in the study of climate change (for example in Cyprus it is useful to come in contact with the Meteorology Department and the Cyprus Research Institute which has as one of its priorities the climate change). These experts will advise on the issue but also to connect the work with the real world and provide data.* *Involving an IT/Technology teacher (T4) is expected to provide further help on managing technological means that may be needed for handling data related to the object of the project.*
Abstract - Synopsis	**Handling Data in the Context of Climate Change** This topic and the respective L&C Plan are aiming at providing the context to students in order to acquire skills in handling, analyzing, and interpreting data related to climate change, including collection, organization and presentation of such data In the context of the consideration of this topic, it is suggested the development of an approach that will provide to the students a rich and meaningful learning experience that integrates mathematics with real-world applications and critical problem-solving skills. It also promotes a holistic understanding of the extent and repercussion of climate change through the consideration of the related data, including their impact on society and ethical considerations.

	The students are expected to be involved in project activities that will provide the opportunity for interest development, Data Analysis Study, Case Studies and Research Studies, Field Trips and Data Collection. Furthermore it is expected that the students will have opportunities for Debates and Discussions, Data Visualization Activities and Guest Speakers and Expert Interviews They are also expected to be involved in the development of a Project-Based Learning (PBL).
References, Acknowledgements	There is ample literature on the topic but the students can give emphasis on: Their textbooks on Geography, Chemistry and Statistics/ Mathematics Information from the Internet for the various issues already mentioned in the guiding questions. For local issues the resources can be suggested by the experts mentioned earlier. Some useful information can be gathered from (1) Planning for learning - Institute for Teaching and Learning Innovation https://itali.uq.edu.au/teaching-guidance/teaching-practices/planning-learning. (2) Creating the school development plan. https://www.cambridgeinternational.org/Images/271307-creating-the-school-development-plan.pdf. (3) Using Effective Questions | Center for Teaching Innovation. https://teaching.cornell.edu/using- effective-questions. NASA - https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool UN - https://earthmap.org/ C-ROADS - https://www.climateinteractive.org/c-roads/ IPCC - https://interactive-atlas.ipcc.ch/ FT - https://ig.ft.com/climate-game/ CALACADEMY - https://www.calacademy.org/cornucopia ILLUMINATE - https://ic3uwaterlooca.itch.io/illuminate VENTUSKY - https://www.ventusky.com

2. STEAME ACADEMY Framework*

Teachers' Cooperation	Teacher T1 (teacher of geography) with main responsibility in the geographical aspects of climate change, regional variations and impact on ecosystems. T1 is expected to collaborate with T2 and T3 in integrating geographical data into the project. T2 (science teacher) is expected to provide scientific context and support understanding of climate change, its causes and impact. T2 is expected to collaborate with T3 in providing/ collecting data and support in the analysis and scientific interpretation of their implications. T3 (mathematics teacher) is expected to help/ teach/ provide resources on data handling, statistical analysis and modelling. T3 is to cooperate with T2 in identifying relevant mathematical concepts and processes that can be used in the project. Furthermore, T3 will guide students in analysing and interpreting data using mathematical techniques and models. T4 (IT/Computer Science teacher) will support the students though the suggestion/ explanation of data analysis software and presentation/ visualization technological tools. In particular T4 is expected to support students on models to present and exploit their findings. Teacher's 1 cooperation with Teacher 2 in case of learning elements involving the two different disciplines
STEAME in Life (SiL) Organization	The teachers should meet at the initial stages and identify the basic aspects that are needed for the study of climate change and its repercussions on real life. Furthermore, they should exchange ideas with an expert on the field and identify actions that could be taken as a result of the consideration of the data in real life situations. Based on these they proceed to the Action Plan Formulation

Action Plan Formulation	*STAGE I: Preparation by field one or more teachers [STEPS 1-4], and* *STAGE II: Action Plan Formulation [Preparation STEPS 1-3]* *Refers to the creation of this Learning Plan, by teachers in collaboration.* *STAGE III: Action Plan Formulation [Development STEPS 4-18]* *Refers to the realization by the students of the various activities of the Learning Plan.* *The support, feedback and evaluation by the teachers are followed throughout the implementation of the activities.*

3. Objectives and Methodologies

Learning Goals and Objectives	Acquire skills in handling, analyzing, and interpreting data related to climate change, including collection, organization and presentation of such data Develop mathematical skills including use of statistical concepts and techniques as well as competences for modelling, representation and interpreting data in the context of climate change Utilize technological means and packages for collection, visualization, analysis and communication of such data Promote critical thinking and problem-solving competences Explore interdisciplinary connections, recognizing the broad implications of climate change to real life aspects and issues. Instill and foster environmental awareness through the exploration of data Assess the student's skills in handling data in the area of climate change Encourage Peer Collaboration Reflection on environmental impact through the interpretation and use of data
Learning Outcomes and expected Results	Overall, the project is expected to provide to the students a rich and meaningful learning experience that integrates mathematics with real-world applications and critical problem-solving skills. It also promotes a holistic understanding of the extent and repercussion of climate change through the consideration of the related data, including their impact on society and ethical considerations.
Prior Knowledge and Prerequisites	Handling data in the context of climate change is a topic that requires students to have some prior knowledge and prerequisites in order to understand and apply the concepts effectively. Some of the possible prior knowledge and prerequisites are: Basic understanding of climate change and its causes, effects, and solutions. This can include the concepts of greenhouse gases, global warming, carbon footprint, mitigation, and adaptation. Familiarity with data sources and data types related to climate change. This can include the types of data collected by satellites, weather stations, sensors, and surveys, and how they are categorized into numerical, categorical, spatial, temporal, and textual data. Basic Proficiency in data handling skills and techniques, such as collecting, organizing, summarizing, visualizing, analyzing, and interpreting data. This can include the use of tables, charts, graphs, maps, statistics, and software tools to manipulate and present data in meaningful ways Ability to communicate and critique data and findings related to climate change. This can include the use of appropriate language, terminology, and evidence to convey and evaluate data-based arguments, claims, and recommendations. Further to the resources mentioned earlier one can use: The World Bank: Climate Change Portal The EU project: TEACHING THE FUTURE (https://teachingthefuture.eu)
Motivation, Methodology, Strategies, Scaffolds	The students are provided with challenging events on climate change through a broad range of means, including videos, literature etc as the issue is of great concern, and are called to analyze, mediate and study it by considering the need

	for approaches developing mathematical models that would provide us with the means for understanding, prediction and conclusion on their effects in the spirit of the critical driving questions presented earlier, thus forming views on the pros and cons of reaching inferences on the concern on climate change in the context of real world. The basic methodology is the one for project based on Problem-solving and should provide ample opportunities for discussion. Project work is also an important tool in the methodology of approaching this issue as it can provide the context for creating the background as well as the framework for investigation and consideration of the various issues that step out during the consideration of the driving questions identified in section 1.

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	Ensure that the learning plan aligns with the curriculum standards and objectives relevant to the students' grade level Conduct thorough research on the topic of climate change, including its causes, impacts, and the role of data in understanding and addressing it. Anticipate the diverse needs and learning styles of students and plan activities and resources that cater to these differences. Incorporate hands-on and interactive activities, such as data analysis exercises, simulations, and experiments, to actively engage students in the learning process. Utilize technology tools and platforms, such as data visualization software and online databases, to facilitate data exploration and analysis. Create a flexible learning environment that accommodates various instructional modes, including whole-class instruction, small group activities, and independent exploration.
Resources, Tools, Material, Attachments, Equipment	Some possible resources, tools, material, attachments, and equipment for school students to learn about handling data in the context of climate change are: Online courses and textbooks that can help students in collecting, analyzing and visualizing data for example NASA Data Resources Human Climate Horizons Climate Change Knowledge Portal Statistical Packages that can be used for handling data. In particular for this level (school students ages 12-18) the Microsoft Excel can be exploited at the school level (and not only) Furthermore Artificial Intelligence tools can be exploited for handling Data. Videos, animations, simulations, and games that illustrate the concepts and applications of data science and climate change, such as NASA Climate Kids. Case studies and experiments that demonstrate the use of data science and climate change in real-world scenarios. Classrooms, labs, libraries, outdoor spaces, and virtual platforms that provide a conducive learning environment for collaboration, creativity, and innovation, such as [Google Classroom]
Health and Safety	-

5. Implementation

Instructional Activities, Procedures, Reflections	**INTEREST DEVELOPMENT** Develop interest by asking the students to consider a recent paper or discussion or political conference on the issue of climate change

	and challenge them to proceed in identifying data and developing methods and means for handling such Data. One or more of the following activities is providing a framework for the study of the topic: **Data Analysis Study:** Provide them with climate datasets (e.g., temperature, precipitation) and ask them to analyze the data to identify trends, patterns, and anomalies. Guide students through the process of graphing the data using software like Excel or online tools, and then interpreting the graphs to draw conclusions about climate change **Case Studies and Research Studies:** Assign students to research specific case studies where data analysis played a crucial role in understanding climate change impacts (e.g., melting ice caps, extreme weather events). Have students present their findings, including the data collected, analyzed, and the implications for climate change mitigation and adaptation strategies. **Field Trips and Data Collection:** Organize field trips to local ecosystems, weather stations, or environmental monitoring sites where students can collect data relevant to climate change (e.g., temperature, precipitation, biodiversity). After collecting data, guide students in analyzing and interpreting their findings, relating them to broader climate change trends. **Debates and Discussions:** Divide the class into groups and assign each group a specific aspect of climate change data (e.g., temperature rise, sea level rise, CO2 emissions). Have groups research and prepare arguments to support their stance on the significance of their assigned data in understanding climate change. Then, facilitate a debate or discussion where students can present their findings and counterarguments. **Data Visualization Activities:** Introduce students to various data visualization techniques, such as creating graphs, charts, and maps to represent climate data effectively. Provide opportunities for students to practice creating their visualizations using software tools or by hand, emphasizing clarity and accuracy in communicating data trends. **Guest Speakers and Expert Interviews:** Invite scientists, researchers, or professionals working in the field of climate change and data analysis to speak to the class or participate in virtual Q&A sessions. Students can prepare questions in advance and engage with the guest speaker to gain insights into the real-world applications of data analysis in addressing climate change challenges. **Project-Based Learning (PBL):** Design a project-based learning experience where students work collaboratively to investigate a specific aspect of climate change using data analysis techniques. Encourage students to identify research questions, collect and analyze data, and present their findings in a final project report or presentation.
Assessment - Evaluation	Some points and criteria for assessing the outcomes of the study/ activity on the topic are: The accuracy and reliability of the data sources, methods, and tools used for collecting, analyzing, and interpreting data related to climate change. The relevance and applicability of the data and information to the specific context, objectives, and questions of the study. The clarity and completeness of the data presentation, visualization, and communication, using appropriate formats, languages, and styles. The depth and breadth of the data analysis, interpretation, and synthesis, showing the understanding of the science, causes, consequences, and solutions of climate change. The critical thinking and problem-solving skills demonstrated in the data analysis, interpretation, and synthesis, showing the ability to identify, evaluate, and

	address the challenges and opportunities of climate change adaptation and mitigation. The creativity and innovation skills demonstrated in the data analysis, interpretation, and synthesis, showing the ability to generate, explore, and implement novel and effective ideas and solutions for climate change adaptation and mitigation. The collaboration and participation skills demonstrated in the data collection, analysis, interpretation, and synthesis, showing the ability to work with and learn from others, including stakeholders and partners from different sectors and backgrounds. The reflection and evaluation skills demonstrated in the data collection, analysis, interpretation, and synthesis, showing the ability to monitor, assess, and improve the learning process and outcomes. The effectiveness of use of the various constituents of STEAME in the context of the study as well as in the relation to real world issues.
Presentation - Reporting - Sharing *Extensions - Other Information*	The collaborating teachers need to reflect and discuss the outcomes of the topic in the context of their subject area as well as in the context of the STEAME goals

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: _____
Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1(T1) Cooperation with T2 and student guidance	**Activities /Steps** **By Students** Age Group: ____	**Activities /Steps** Teacher 2 (T2) Cooperation with T1 and student guidance
A	Preparation of steps 1,2,3		Cooperation in step 3
B	Guidance in step 9	4,5,6,7,8,9,10	Support guidance in step 9
C	Creative Evaluation	11	Creative Evaluation
D	Guidance	12	Guidance
E	Guidance	13 (9+12)	Guidance
F	Organization (SIL) STEAME in Life	14 Meeting with Business representatives	Organization (SIL) STEAME in Life
G	Preparation of step 15		Cooperation in step 15
H	Guidance	16 (repetition 5-11)	Support Guidance
I	Guidance	17	Support Guidance
K	Creative Evaluation	18	Creative Evaluation