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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - L.2 TEACHERS
Ancient Greek Innovators: Exploring and Recreating Technology

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1. Overview

Title	Ancient Greek Innovators: Exploring and Recreating Technology	
Driving Question or Topic	How can understanding and recreating ancient Greek innovations in traditional and digital format will enhance our problem-solving skills and inspire modern technological advancements?	
Ages, Grades, …	12-15	8th-9th grade (Gymnasium)
Duration, Timeline, Activities	20 hours	10 sets of 2X45-50 minutes lessons (10-15' break)
Curriculum Alignment	**Sciences:** -Physics (electromagnetics) **Technology:** -Informatics (information, telecommunications) **Engineering:** -Design and assembly -Programming micro-controllers **Arts:** -Design with sustainable materials **Mathematics:** -Algebra (information coding, numerical systems, Boolean logic) -Statistics (basic data analysis) **Entrepreneurship:** -	
Contributors, Partners	-Technological museums -IT/Telecommunication company	
Abstract - Synopsis	The learning and creativity plan refers to an intervention where students, acknowledging the importance of communications in the evolution of human civilization, try to recreate and test one ancient Greek technology (phryctoria) as a proof of concept.	
References, Acknowledgements	Phryctoria (source Wikipedia, https://en.wikipedia.org/wiki/Phryctoria) Micro:bit: https://microbit.org/	

2. STEAME ACADEMY Framework*

Teachers' Cooperation	**Informatics teacher (T1)** ● Coordination of the project. ● Presentation of the concepts of networks and information. ● Working with students for thew programming of a micro-controller to simulate the phryctoria functionality. ● Investigation with students and other teachers the functional requirements of the phryctoria project. **Physics teacher (T2)** ● Presentation of the concepts of electromagnetics and the theory of communication. ● Investigation with students and other teachers the functional requirements of the phryctoria project. **Arts teacher (T3)** ● Supporting students on the aesthetic design and the incorporation of product features in an appealing way. ● Collaboration with the other teachers and students on the results of the proposed design. **Mathematics teacher (T4)** ● Presentation of the concepts of coding systems. ● Presentation of the way that phryctories/persies works. ● Providing assistance and guidance to the students related to any calculations needed. T1 cooperates with T2 and T4 on the design and test of the ancient technology in the traditional and digital format T1 cooperates with T3 on the aesthetic aspects of the product to be developed by the students and on the final details of the presentation of the product (name, logo, coloring etc)
STEAME in Life (SiL) Organization	● Visit to a telecommunication company to get information about how modern telecommunications networks are organized. ● Visit to a technological/IT museum to get information about various technologies. ● Meeting with an external telecommunications engineer to get information about wireless and cable communications.
Action Plan Formulation	**Step 1: Theoretical background knowledge (3 hours)** ● Informatics teacher (T1) explains to the students the basic concepts of networks and communications and in general the context of the ancient Greek technologies. ● Physics teacher (T2) explains to the students the basic concepts of electromagnetic theory and its role to modern communications. ● Mathematics teacher (T4) explains to the students the basic concepts of information coding. **Step 2: Extension of theoretical knowledge and connection with the real world (1 hours)**

- Teacher T1, T2, T4 work together with the students to present and explain in an historical and societal context the evolution of communications and correlate it with the current needs and problems of the 4th Industrial Revolution.

Step 3: Formulation and definition of the project (2 hours)

- Teacher T1, T2, T3, T4 work together with the students to:
  - sum up all the information,
  - define the main objectives of the project,
  - define the main user requirements of the technology to be re-created by the students,
  - define the workplan schedule and allocation of tasks among the students,
  - formulate working groups.

Step 4: Application of knowledge and implementation (12 hours)

- Students analyze and list the materials, equipment and tools that will be used for the design, development and test of the product in both the original and the digital format.
- Students with the support of the science teacher define which materials will be new and which recycled and where they can find them.
- Students gather information on the ecological impact of the resources to be used on the product.
- Students with the support and guidance of the teachers design the ancient technology “phryctoria” in the original format.
- Students with the support and guidance of the teachers design the ancient technology “phryctoria” in the digital format using a micro-controller.
- Informatics and math teacher is supporting on providing useful and appropriate prompts to get the desired results.
- Students with the support of the teachers runs various examples and compare the functionalities of the two formats of the product.

Step 5: Results presentation and evaluation (2 hours)

- Students present their results to the teachers or other peers.
- Teachers evaluate the implementation and result of the project.

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

3. Objectives and Methodologies

Learning Goals and Objectives	Learning goals of the project: **LG#1:** Introduce students to the concept of communications **LG#2:** Present and familiarize the students with the methods and approaches of ancient Greek technologies **LG#3:** Analyze the connection between technology innovations and civilization **LG#4:** Familiarize students with the use of coding methods Learning objectives **LO#1**: Students will understand the concept of ancient Greek technologies **LO#2**: Students will know about the need for communication through the evolution of human civilization

	LO#3: Students will know how to communicate with or without digital technologies **LO#4:** Students will familiarize themselves with the phases of designing an artifact **LO#5:** Students will familiarize themselves with the programming of a micro-controller
Learning Outcomes and expected Results	After completing the project students should: **Knowledge** ● Know about the ancient Greek technology ● Understand the importance of communications and networks ● Understand the importance of information coding ● Know how people can communicate with analogue and digital means **Skills** ● Create a technological artefact ● Program a micro-controller ● Create coded messages using coding methods **Attitudes** ● Raise awareness on the idea of networking and communicating ● Develop interest in programming
Prior Knowledge and Prerequisites	**Prior knowledge-skills:** ● Basic use of micro-controllers ● Basic use of office applications suite ● Communication and cooperation skills ● Basic use of the internet for information search ● Teamwork skills **Prerequisites:** ● Laboratory with access to the internet, computers and micro-controllers ● Teleconference platforms ● Access to office suite applications ● Presentation equipment ● Access to printing equipment
Motivation, Methodology, Strategies, Scaffolds	**Motivation** ● Mathematics, Informatics, History ● Product design ● Real world connection ● 4th Industrial Revolution **Methodology** Project based approach that involves the collaboration between teachers of Science, Mathematics, Informatics and Arts and the collaboration of the group of students during all the phases of the design of a technological artefact. **Strategies** Project based learning Autonomous work Teamwork Guided discovery

	Brainstorming **Scaffolds** Guidance and consultancy from teachers Additional information from experts Support during lab work from teachers

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	**Preparation** The teacher in charge of the project is the informatics teacher. Initially he/she discusses with the other teachers the goals of the project and the actions to be taken for its implementation. The teacher reviews the initial sources of information and the resources to be used and discusses with the other teachers about the potential workplan. All the teachers together formulate an initial document for the presentation of the concept to the students. All the teachers take care to identify what will be needed for their part of the intervention in terms of materials, resources and infrastructures. The informatics teacher makes a preliminary contact with the external actors involved in the project to identify their availability, and he checks on the availability of the computer laboratory and all the needed applications and platforms. The science and math teachers discuss together on how to effectively present the various theoretical concepts to the students and the art teacher provides ideas about materials to be used. **Space setting** The implementation of the project requires the following settings: -Classroom, where students can work collaboratively to create the “phryctoria” artefact, test it and present it. The classroom has to be equipped also with presentation equipment (computer, projector and office applications) and have a connection to the internet for the online meetings with the external experts. -Computer laboratory with internet access and micro-controllers equipment where students can work individually or in pairs. **Troubleshooting/tips** Special care has to be taken about students’ visit to the museum and the telecommunications company, regarding all the necessary permissions and security issues.
Resources, Tools, Material, Attachments, Equipment	**Educational resources and materials** Teachers can use the resources mentioned in the references section supplemented by additional custom developed materials focusing on sustainability design **Tools and equipment** The implementation of the project requires basic equipment and software namely ● Computer laboratory with access to the internet ● Office suite applications (word, excel, PowerPoint) ● Presentation equipment in classroom ● Teleconference platform ● Classroom where teleconferences can be held ● Micro-controllers equipment like micro:bit

Health and Safety	-Provisions must be made for assuring the health and safety of students during their visits. -If students during the project bring materials in physical form additional precautions for their health and safety during the handling of materials must be taken (e.g. for toxic materials, very small materials etc).

5. Implementation

Instructional Activities, Procedures, Reflections	The project is implemented extending to 20 study hours separated in 10 lesson blocks of 2 study hours each. Classes are held once a week in the context of course of informatics in secondary education. The leading teacher (Teacher 1 – T1 – informatics teacher) participates in all the activities and the other teachers (Teacher 2 – T2 - science teacher), (Teacher 3 – T3 – arts teacher), Teacher 4 – T4 – math teacher) are involved in specific parts of the project where their participation has been scheduled. **Lesson block 1 (2h: Lesson 1 & 2)** T1, T2, T4 20 min: presentation of the project idea to students T1 15 min: explains to the students about the ancient Greek technologies T1 35 min: explains to the students the basic concepts of networks and communications T2 20 min: explains to the students the basic concepts of electromagnetic theory and its role to modern communications **Lesson block 2 (2h: Lesson 3 & 4)** T4 30 min: explains to the students the basic concepts of information coding T1, T2, T4 30 min: work together with the students to present and explain in an historical and societal context the evolution of communications and correlate it with the current needs and problems of the 4th Industrial Revolution T1, T2, T4 30 min: presentation of the project evaluation guidelines and deliverables to the students **Lesson block 3 (2h: Lesson 5 & 6)** T1, T2, T3, T4 15 min: gather all information so far 15: definition of objectives of the project 30: definition of user and functional requirements of the product 30: definition of workplan, roles and working groups **Lesson block 4 (2h: Lesson 7 & 8)** T1 90 min: visit (F2F or online if possible) a telecom company, meeting with a telecom engineer **Lesson block 5 (2h: Lesson 9 & 10)** T1, T2 90 min: visit (F2F or online if possible) a technology museum **Lesson block 6 (2h: Lesson 11 & 12)** T1, T4

	45 min: students organize materials, equipment and tools 45 min: students start the design of the original form of “phryctoria” **Lesson block 7 (2h: Lesson 13 & 14)** T1, T3, T4 90 min: students work on the prototype of the original form of “phryctoria” **Lesson block 8 (2h: Lesson 15 & 16)** T1, T2, T4 90 min: students work on the prototype of the digital form of “phryctoria” **Lesson block 9 (2h: Lesson 17 & 18)** T1 45 min: students run various examples with the two prototypes T3 45 min: students think about the presentation of their work **Lesson block 10 (2h: Lesson 19 & 20)** T1, T2, T3, T4 45 min: students present their project 45 min: teachers evaluate the deliverables and provide feedback to the students
Assessment - Evaluation	Evaluation of the project and its results is performed in two ways and by all teachers: a) Level of participation, involvement and contribution of each student is evaluated, based in direct observation by the teachers where a rubric can be used or a journal of observations. b) Final result is evaluated based on the presentation and the arguments with which they supported their decisions and their final outcome.
Presentation - Reporting - Sharing	The final expected results of the project are 1. A report in word format containing the steps, the logic behind the two prototypes (analogue and digital “phryctoria”) and the comparison (+/-). 2. A presentation of the designed product and its features. 3. A brief personal log of participation and personal experience from each student. 4. The product itself in analogue and digital format
Extensions - Other Information	The project can be extended to more complicated coding schemes.

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 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: Ancient Greek Innovators: Exploring and Recreating Technology
Brief Description/Outline of Organizational Arrangements / Responsibilities for Action

STAGE	**Activities/Steps** Teacher 1 (T1) Cooperation with other teachers and student guidance	**Activities /Steps** Teacher 2 (T2) Cooperation with other teachers and student guidance	**Activities /Steps** Teacher 3 (T3) Cooperation with other teachers and student guidance	**Activities /Steps** Teacher 4 (T4) Cooperation with other teachers and student guidance	**Activities /Steps By Students** Age Group: 12-15
A	Preparation of steps 1,2,3	Cooperation in step 3	Cooperation in step 3	Cooperation in step 3	-
B	Guidance, support in step 9, 10	Guidance, support in step 9, 10	Support in step 6, 7	Guidance, support in step 9, 10	4,5,6,7,8,9,10
C	Creative Evaluation	Creative Evaluation	Creative Evaluation	Creative Evaluation	11
D	Guidance	Guidance	Guidance	Guidance	12
E	Guidance	Guidance	Guidance	Guidance	13 (9+12)
F	Organization (SIL) STEAME in Life	Organization (SIL) STEAME in Life	Organization (SIL) STEAME in Life	Organization (SIL) STEAME in Life	14 Meeting and visit to the museum
G	Preparation of step 15	Cooperation in step 15	Cooperation in step 15	Cooperation in step 15	
H	Guidance	Support Guidance	Support Guidance	Support Guidance	16 (repetition 5-11)
I	Guidance	Support Guidance	Support Guidance	Support Guidance	17
K	Creative Evaluation	Creative Evaluation	Creative Evaluation	Creative Evaluation	18