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STEAME ACADEMY TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2 SERVICE TEACHERS: IS EVERYTHING INVENTED?

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1. Overview

Title	Is everything invented?		
Driving Question or Topic	How many things are there in the world that did not exist until someone invented them? What are they invented for? How are they invented?		
Ages, Grades, ...	12-15		
Duration, Timeline, Activities	11 learning hours	11 60 minutes class	6 Activities. 11 sessions
Curriculum Alignment	Technology; social sciences; math; communication; autonomy;personal initiative and entrepreneurship		
Contributors, Partners			
Abstract - Synopsis	The activity is based on reflection on how many things there are in the world did not exist until someone invented them. The concept of invention is introduced within different activities: knowing what an invention is, identifying some inventors and what needs the created products covered. Secondly, the process of generating an invention is introduced. Finally, students work as a team to identify a need and create their own, original invention with the aim of improving people's lives. The last phase included the public exhibition of the creations to the community.		
References, Acknowledgements			

2. STEAME ACADEMY Framework*

Teachers' Cooperation	<ul style="list-style-type: none"> • The tutor teacher will present the challenge and give the students a base of orientation with all the phases of the project. • The art teacher will organize the group into teams and give them the materials so that they can create their own image and name as a group. In the last phase, he/she will help students in the search for materials and the creative part of the invention. He/She can also support the public presentation of inventions. • The social sciences teacher will help students review the inventions in history, what needs they wanted to cover, and also get to know some inventors. • The technology teacher will help them in the design and creation process of the invention.
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STEAME in Life (SiL) Organization	<ul style="list-style-type: none"> ● Arrange meetings with local business leaders and community business representatives to share inventions. ● Highlight the entrepreneurial aspect by showing how their inventions can be turned into business initiatives.
Action Plan Formulation	<p>Preparation</p> <ul style="list-style-type: none"> ● Curriculum integration: align the project with the curriculum across subjects ● Resource gathering: coolest materials and resources necessary for the project ● Conduct meetings among teachers to divide responsibilities and plan the project timeline ● Present the project to students, explaining the objectives, phases, and expected outcomes <p>Development</p> <ul style="list-style-type: none"> ● Research: Students research various inventions and their purposes. ● Team Formation: Students form teams and brainstorm ideas for their invention. ● Idea Generation: Each team selects a need they want to address and conceptualizes an invention. <p>Configuration & Results</p> <ul style="list-style-type: none"> ● Design and Build: Students design and create prototypes of their inventions with guidance from teachers. ● Feedback Sessions: Teachers provide regular feedback and support during the invention process. ● Testing and Refinement: Students test their prototypes, make improvements, and finalize their designs. ● Evaluation: Teachers assess the projects based on creativity, feasibility, and alignment with the identified need <p>Review</p> <ul style="list-style-type: none"> ● Assessment Review: Evaluate student performance and the effectiveness of the project. ● Teacher Debriefing: Teachers discuss what worked well and areas for improvement. ● Documentation: Compile documentation of the project process and results for future reference. <p>Project completion</p> <ul style="list-style-type: none"> ● Public Exhibition: Organize a public event where students present their inventions to the community. ● Reflection: Students reflect on their learning experiences and outcomes of the project. ● Certificates and Awards: Acknowledge students' efforts and achievements with certificates or awards

** under development the final elements of the framework*

3. Objectives and Methodologies

Learning Goals and Objectives	<p>Knowledge:</p> <ul style="list-style-type: none"> ● Understand the concept of invention, including its historical significance and its role in addressing real-world needs. ● Identify notable inventors and their contributions to society. ● Comprehend the process of generating an invention, including problem identification, ideation and prototyping. ● Learn how to apply scientific principles from disciplines such as physics, materials science, maths or engineering to understand the functioning of their inventions. ● Recognize the importance of scientific inquiry and experimentation in the invention process.
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	<p>Skills:</p> <ul style="list-style-type: none"> ● Analyze problems and identify potential areas for innovation (critical thinking) ● Work effectively in teams, demonstrating collaborative skills such as communication, active listening, and task delegation to achieve common goals. ● Generate original ideas and practical solutions to address identified needs (creativity and problem-solving) ● Apply mathematical concepts such as measurement, geometry and algebra to calculate dimensions, quantities and other parameters relevant to their inventions. ● Use mathematical reasoning to optimize designs and solve engineering problems. ● Communicate ideas clearly, using verbal, written and visual communication techniques to convey the purpose and benefits of the invention. <p>Attitudes:</p> <ul style="list-style-type: none"> ● Maintain an open mindset and curiosity and seek new ideas. ● Understand the perspectives of others to create inventions that address real-world problems ● Embrace challenges as opportunities and improvement during the invention process
Learning Outcomes and expected Results	<ol style="list-style-type: none"> 1. Research historical and contemporary inventions, citing examples of notable inventors and their groundbreaking creations. 2. Understand the problem-solving process involved in generating and invention, including problem identification, ideation and prototyping. 3. Design and create a useful prototype of their invention, demonstrating practical application and addressing the identified need. 4. Collaborate effectively in teams to identify a real-world need and develop an original invention. 5. Communicate ideas clearly and present the inventions to a broader audience. 6. Reflect critically on the social impact of inventions , exploring ethical considerations and implications for sustainability, equity and social justice in the innovation ecosystem.
Prior Knowledge and Prerequisites	<ul style="list-style-type: none"> ● Science, Maths and Technology: students should have a foundational understanding of basic scientific concepts and technologies in order to understand the principles behind inventions. ● Math and engineering: understand fundamental engineering concepts such as materials and structures and mechanics to inform the design and construction of inventions. Apply mathematical principles to calculate dimensions, quantities and other parameters relevant to the invention process. ● Collaboration skills: experience working in teams will help students to collaborate with their peers. ● Creativity and arts: creative thinking will be beneficial for generating original ideas for inventions.
Motivation, Methodology, Strategies, Scaffolds	<p>The teaching methodology involves a combination of inquiry based learning, hands-on activities and group work:</p> <p>IBL:</p> <ul style="list-style-type: none"> ● This methodology involves pidgin open-ended questions or challenges to students to stimulate curiosity and discovery. Students will engage in guided inquiries to understand the concept of invention, identify notable inventors and explore the needs that their inventions addressed.

- Students will participate in research and discussions to investigate various inventions and their inventors. They will search information on the Internet, make observations and draw conclusions based on their findings.
- The purpose of this strategy is to foster critical thinking, research skills by allowing students to actively explore and construct their own knowledge

Hands-on activities:

- This strategy involves experiential learning where students engage directly with materials, tools and processes to construct and create their own invention. Students will apply their understanding of invention concepts to design and built their own original inventions.
- Students will work in small groups to brainstorm ideas and design prototypes. They will have access to various materials and tools to bring their ideas to life.
- The purpose of hands-on activities is to promote creativity, problem-solving skills and practical application of knowledge.

Group work:

- It involves collaborative learning, students work together in teams to achieve a common goal. Students will collaborate as a team to identify a news, create their invention and prepare for the public exhibition.
- Students will collaborate to share ideas, divide tasks and contribute to identify a need, design, construct and present their invention. They will engage in discussions, negotiations and decision-making processes to ensure the success of the project.
- The purpose of group work is to develop teamwork skills, communication abilities, cooperation, mutual suport and collective responsibility.

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*

Space setting:

- Classroom with tables where students can gather for discussions and hands-on activities. The space should be flexible to accommodate different types of group configurations.
- Presentation area: in the same class of in another space a separate are for the public exhibition is needed. The area should be sufficient lighting and display surfaces to showcase the inventions.

Resources, Tools, Material, Attachments, Equipment

Resources and Materials:

- Research materials: access to computers or tablets for online research as well as books, articles or other resources related to invention history, inventors and societal needs. Online resources relating to national inventors with biographies of inventors, invention resources and educational materials will be useful.
- Prototyping supplies: a variety of materials and tools for designing prototypes such as cardboard, paper, tape, makers, measuring tapes, modeling clay, craft sticks, wire, screws, wood, paints or other construction materials.
- Presentation materials: poster boards or computers and presentation software to create visual aids for the public exhibition.
- Digital tools and software such as google docs/slides or other collaboration tools for students to work together on research, planning and presentation materials fo their inventions.

5. Implementation

Instructional Activities, Procedures, Reflections

Session 1: Introduction to project

- The tutor teacher will present the challenge and give the students a base of orientation with all the phases of the project.
- Teacher can generate excitement and enthusiasm among students and establish a sense of purpose for their participation in the project.
- Teacher should explain the goals and objectives of the project as well as the plan for each session and some guidance on assigning roles and responsibilities within a group.
- Students listen attentively to the teacher's presentation and engage in discussions with peers and the teacher about the project goals and objectives.
- Ask questions to clarify doubts and seek additional information about the project.
- Begin thinking about potential invention ideas and areas of interest.

Session 2: Introduction to invention concepts

- The social sciences teacher will begin by introducing the concept of invention and some examples of inventors through a presentation.
- The teacher facilitates an IBL activity by posing questions to the students, encouraging critical thinking and exploration of the invention process. Then he/she provide resources and guidance to assist students in researching specific inventors and their contributions. Teachers offers support and feedback to relevant information.
- In small groups students will gather information about inventions and the needs addressed by them. Then they will conduct a research to uncover details about the biographies of selected inventors, their motivations and the problems or needs their inventions addressed.
- Students will present their findings to the peers, delivering into how the inventions functions, their historical context and the impact they had on society.

Session 3: Brainstorming and idea generation

- The art teacher will organize the group into teams and give them the materials so that they can create their own image and name as a group.
- The technology teacher will present them the phases of the process to create an invention and will help each group to identify real-world needs and evaluate the feasibility of their invention ideas.
- Also technology teacher will offer insights into the technical aspects of invention design and encouraging critical thinking about the practicality and viability of their ideas.
- Create a group with other peers and divide tasks and responsibilities based on individual strengths and interests.
- Collaborate with the group to brainstorm ideas for inventions that address specific needs or problems.
- Discuss and evaluate the feasibility of each idea, considering factors such as technical complexity, resource availability and potential impact on society. Refine and iterate on ideas based on the feedback and analysis.
- Use software tools and resources to design and visualize the invention, incorporating technical information and specifications to create detailed plans and prototypes.

Session 4, 5 and 6: Prototype design and construction

- Art teacher will help students in the search for materials and the creative part of the invention.

- The technology teacher will provide materials and tools for prototyping and guide students in the design and construction process. Also will help to offer technical assistance.
- All teachers should monitor group progress and intervene as needed to address challenges or conflicts and to provide guidance on assigning roles within each group.
- Student work collaboratively to design and build their invention. Apply engineering and mathematical principles to refine the design and ensure functionality and make adjustments to improve performance.

Session 7: Prepare the public exhibition

- Art teacher can assist students in preparing visually presentations and display materials for the public exhibition.
- Language teacher or tutor teacher will provide guidance on communication strategies and presentation techniques.
- Students create presentations that showcase their inventions. and practice presenting their inventions.

Session 8: Public exhibition

- Organize the session and invite the community.
- Present their inventions and answer questions during the session.

Session 9: Reflection

- Teacher guide students in a structured reflection about what their have learned and to evaluate their experience. Provide prompts to help students to reflect on each phase of the project
- Student reflect on their own experiences and learning journey throughout the project.
- Evaluate their collaboration and teamwork within the groups.
- Set personal goals for future projects

Assessment - Evaluation

Formative evaluation process will include:

- Ongoing observation: teacher can monitor group progress during class activities, group work and hands on tasks to consider their engagement, collaboration, problem solving-skills and overall participation in the project. Also, teacher will provide ongoing reviews and will encourage students to explain their design choices, demonstrate the functionality of their prototypes...
- Quizzes: a quiz at the beginning to ensure the understanding of key concepts about inventions, problem-solving process, inventors...
- Peer feedback: during construction sessions (4-5-6) teacher will encourage students to provide constructive feedback to other groups on their ideas and prototypes.
- Self assessment: complete a written reflection or journey entry summarizing their reflections on the project and their individual contributions to the group effort.
- Rubrics: develop and share with students a rubric to assess student work and progress across different aspects of the project: invention design; prototype construction; presentation skills; collaboration; and problem-solving.

Presentation - Reporting - Sharing

As described, there are several moments where students must share ideas, make presentations and produce artifacts. These are:

- Session 2: share findings about notable inventors and their inventions.
- Session 4-5 and 6: prototype design and construction of the invention.
- Session 8: presentation for public exhibition

Extensions - Other Information

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
 - a. Teachers identify thematic areas related to inventions and innovation, such as historical inventions, notable inventors and societal needs that inventions address. Also, knowledge related with engineering and maths principles involved in the process of creating the inventions and the artistic process in the process of create and communicate the ideas.
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
 - a. Teachers can collaborate with parents, local businesses and experts to provide insights, resources and support for the project. For example: they can explore whether a parent has a profession that involves creating objects (inventor, engineer, carpenter). They can also seek the collaboration of local business to give them materials. The whole community can be involved in the public exhibition.
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
 - a. Teachers determine that the project is suitable for students aged 10-12 and align project goals with curriculum standards related to STEAME areas. More specific association with regular curriculum should be discussed in previous meetings considering each specific case.
 - b. Goals and objectives are described above in section 3 of the lesson plan.
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.
 - a. Tutor teacher participates in all sessions and coordinates the process. Social sciences teacher participates in session 2. Art teacher participates in sessions 3 to 7. Technology and/or maths teacher participants in sessions 3-6. More information about teachers actions are described in section 5 of the L&C.

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

Preparation (by teachers)

1. Relation to the Real World – Reflection
 - a. Throughout history, a large number of machines, devices constructions etc. have been created. In our daily life we use objects that satisfy several needs. For example, we use a pen to satisfy the need to write on paper. There are different types of needs: primary needs are those that must be met for survival (food, sleep...) and secondary needs must be met to increase well-being. These needs change according to times and societies.
2. Incentive – Motivation
 - a. Being aware of the objects around us and the process to create them can give you tools to know how to identify needs, think creative ideas and know how to satisfy them using the knowledge of different areas to improve people's lives.
3. Formulation of a problem (possibly in stages or phases) resulting from the above
 - a. Teachers guide students in identifying a problem or need in their community or daily life that could be addressed through the creation of a new invention. Stages to

achieve these goals will be organized through the activities described before: concept of invention, process to generate an invention, create their own and public exhibition.

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

4. Background Creation - Search / Gather Information
 - a. Students conduct research to gather information about existing inventions, inventors and the needs they address.
5. Simplify the issue - Configure the problem with a limited number of requirements
 - a. Students analyze the problem they have identified and identify key requirements for their invention. They simplify the issue to focus on a specific problem statement that their invention will aim to solve.
6. Case Making - Designing - identifying materials for building / development / creation
7. Construction - Workflow - Implementation of projects
 - a. See implementation section
8. Observation-Experimentation - Initial Conclusions
 - a. Students conduct tests to evaluate the functionality and effectiveness of their inventions.
9. Documentation - Searching Thematic Areas (AI fields) related to the subject under study – Explanation based on Existing Theories and / or Empirical Results
 - a. They explore thematic areas related to their invention, such as scientific principles of technological innovations.
10. Gathering of results / information based on points 7, 8, 9
 - a. Students will draw conclusions about the effectiveness of their inventions.
11. First group presentation by students
 - a. Students will present their initial invention concepts to the teachers. They explain the problem they are addressing and the design process.

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

12. Configure STEAME models to describe / represent / illustrate the results
 - a. In the public exhibitions students demonstrate how their inventions integrate science, technology, engineering, arts, mathematics and entrepreneurial concepts.
13. Studying the results in 9 and drawing conclusions, using 12
 - a. Students will analyze the results of their inventions and the process to create them identifying strengths and areas for improvement within the written reflection
14. Applications in Everyday Life - Suggestions for Developing 9 (Entrepreneurship - SIL Days)
 - a. Students will explore the potential applications of their inventions in real-world contexts to improve people's lives.

Review (by teachers)

15. Review the problem and review it under more demanding conditions
 - a. Teachers can review students' inventions 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
 - a. Students should revisit earlier stages of the invention process, incorporating additional requirements and refine their inventions based on feedback.
17. Investigation - Case Studies - Expansion - New Theories - Testing New Conclusions
 - a. Students should explore new possibilities for their inventions

18. Presentation of Conclusions - Communication Tactics.

- a. Students can improve their inventions based on the comments from the community members after the presentation of the final inventions

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

Title of Project:

Is everything invented?

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: 10-12	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