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STEAME TEACHER ACADEMY

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STEAME ACADEMY
TEACHING FACILITATION LEARNING & CREATIVITY PLAN (L&C PLAN) - LEVEL 2
SERVICE TEACHERS: SWEET HIVE VENTURE

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1. Overview

Title	Sweet Hive Venture		
Driving Question or Topic	*How can we develop a small hive?* *Can we consider the environmental issues, such as plastic pollution or habitat conservation?* *What kind of technologies are used to prepare basic and superior beekeeping products?* *Is there an Astonishing Math Behind Honeycomb?* *Is swarm life optimization a good topic?* *How can we plan our budget?* *How to we can promote and practice sustainable beekeeping and business operations, minimizing our ecological footprint, and actively participating in local environmental conservation efforts?*		
Ages, Grades, …	*15-18 years old*	*10-12 grades*	
Duration, Timeline, Activities	*6 learning hours*	*4 x 50 minutes* *1x100 minutes*	*5 activities*
Curriculum Alignment	Beekeeping and beekeeping products valorisation. Beekeeping Technologies. Occupational health and safety rules for beekeeping and beekeeping products processing. Analyzing and interpreting practical situations with the help of statistical or probabilistic concepts. Correlation of statistical or probabilistic data for the purpose of predicting the behavior of a system by analogy with the mode of behavior in studied situations. Optimizing the solution of problems or problem situations by choosing appropriate strategies and methods. Entrepreneurial mindset		
Contributors, Partners	*School partners from agricultural and forest business*		
Abstract - Synopsis	*The aim of this PL&C is to provide the basis for a STEAME team to empower high-school students with knowledge, skills, and attitudes to innovate in beekeeping entrepreneurship by establishing a sustainable beehive business that produces and sells honey and wax products while promoting environmental awareness and conservation by modern technologies and methodologies.*		
References, Acknowledgements	Beekeeping, Curriculum: https://www.edu.ro/sites/default/files/_fi%C8%99iere/Invatamant-Preuniversitar/2016/profesional/CRR_cl_IX_inv_prof_Silvicultura.pdf		

	Entrepreneurial Education, https://rocnee.eu/images/rocnee/fisiere/programe_scolare/2023/OM_SOC/Educatie%20antreprenoriala_clasa%20a%20X-a.pdf Alexandru V. et al. Manualul apicultorului (ed 7)/ Beekeeper's Manual Romanian Beekeepers Association, 2002, https://apiardeal.ro/biblioteca/carti/Romanesti/Manualul_Apicultorului_Ed._07_de_A.C.A._322_pag.pdf ***, Beekeeping basics, https://denton.agrilife.org/files/2013/08/beekeeping-basics.pdf ***, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9110387/ ***, https://www.mdpi.com/2076-3417/12/21/11179 ***, https://www.taylorfrancis.com/chapters/edit/10.1201/9781315194677-1/beekeeping-technology-honey-processing-emerging-entrepreneurship-rural-areas-vishal-singh-deepak-kumar-verma-deepali-chauhan ***, https://www.izslt.it/wp-content/uploads/2020/05/CA9182EN.pdf ***, https://orca.cardiff.ac.uk/id/eprint/53653/1/Yuce%202013.pdf

2. STEAME ACADEMY Framework*

Teachers' Cooperation	*The four teachers cooperate to fulfill the objectives of the topic under debate. Teacher 1 (Biology/Agriculture/Forestry) – will provide knowledge on beekeeping: The Colony and Its Organization, Colony Management, Honey Production and Processing.* *Teacher 2 (Technology) – will provide knowledge on technologies used to process honey and innovative technologies to obtain new beekeeping products.* *Teacher 3 (Math) – will provide knowledge on geometry of beehives. Beehives are made of walls, each of the same size, enclosing small hexagonal cells where honey and pollen is stored, and bees are raised. It will present some of the mathematical advantages of hexagonal tiling, and swarm life optimization, including the Bee optimization algorithm and its applications.* *Teacher 4 (Entrepreneurship) – will update knowledge on main topics in business education: from starting a business to optimizing the business under ethical consideration and environment protection. Business ideas related to* beekeeping products will be investigated.
STEAME in Life (SiL) Organization	*Meeting with business representatives/Applications in real world Entrepreneurship – STEAME in Life (SiL) Days*
Action Plan Formulation	*Work plan and steps with clear goals and activities for student teachers. The following topics will be covered by teachers involved in project:* *Activities of Teacher 1:* *1.1. Beekeeping Basics* *1.2. Bees and the environment* *1.3. Beekeeping products* *1.4. Supporting a healthy life.* *Activities of Teacher 2:* *2.1. Beekeeping systems* *2.2. Beehives and beekeeping tools* *2.3. The technology of obtaining bee products* *2.4. Planning work in the apiary.* *Activities of Teacher 3:* *3.1. The architecture of honeybee combs* *3.2. Swarm intelligence* *3.3. Geometric features*

	3.4. Social organization *3.5. Optimization algorithms.* *Activities of Teacher 4:* *4.1. Business Idea Generation* *4.2. Funding the business* *4.3. Legal Issues in the field* *4.4. Marketing* *4.5. The Business Plan* *4.6. The Entrepreneur and the community* *4.7. Do your research on sustainability.* *Common activities:* *5.1. Let us start a business. Specific laws related to beekeeping.* *5.2. Let us design a beehive.* *5.3. Identify best practices in beekeeping. Environmental protection. Ethics.* *5.4. Create a first product. Evaluate its quality.* *5.5. Promote the product.* *5.6. Evaluation - Each teacher follows the assessment methodology: assesses students' teamwork, knowledge, presentation and communication skills, abilities.*

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

3. Objectives and Methodologies

Learning Goals and Objectives	***1- Knowledge*** • *Define key terms for bees: bee anatomy, the pollination process, and the role of bees in maintaining ecological balance* • *Identify the practical skills in beekeeping, product development, and sustainable business management.* • *Explain the geometric structure of Honeycombs.* • *Explain the BEE algorithm.* • *Explain the statistical methods used in data analysis and prediction.* • *Define the main terms for a business plan (mission statement, vision)* • *Identify the marketing strategy, operational plan* • *Explain the significance of percentages, costs, loans involved in the beekeeping development* ***2- Skills*** • *Analyze the pollination process.* • *Construct different architectural schemes of beehives* • *Solve a bee-inspired optimization problem* • *Construct the operational plan and marketing strategy* • *Create a brochure text for this business that would help promote the business model to other schools* • *Perform statistical analysis, hive productivity calculations.* ***3- Attitudes*** • *To acknowledge positive impact on both the local ecosystem and the lives of the students involved* • *Commitment- to equip high-school students with practical entrepreneurial experiences, promoting environmental awareness, conservation, and ethical business practices* • *Responsibility promoting and practicing sustainable beekeeping and business operations, minimizing our ecological footprint, and actively participating in local environmental conservation efforts.* • *Recognize the value of interdisciplinary knowledge-Beekeeping involves biology (study of bees), mathematics (data analysis), and potentially technology (monitoring hive conditions), offering a multidisciplinary STEAME experience. integrating math and social sciences in understanding demographic phenomena.*

Learning Outcomes and expected Results	*Students who engage with Sweet Hive Venture will develop competences in sustainable entrepreneurship, encompassing the ability to apply ethical and environmentally conscious practices in a real-world business context.* ● *Students will demonstrate competence in sourcing sustainable materials for honey and wax products, making informed decisions that align with the business's commitment to environmental stewardship.* ● *Students will gain knowledge about bee anatomy, the pollination process, and the role of bees in maintaining ecological balance.* ● *Students will acquire knowledge of the various stages of bee development, understand the mechanics of pollination, and appreciate the significance of bees in agriculture and biodiversity.* ● *Students will develop practical skills in beekeeping, product development, and sustainable business management.* ● *Students will acquire hands-on skills in hive inspection, honey extraction, and the creation of beeswax products.* ● *They will also develop entrepreneurial skills in product marketing and business planning.*
Prior Knowledge and Prerequisites	*Students should have general knowledge on insects' life, basic geometry, optimization methods, and common knowledge on sweet products on the market.*
Motivation, Methodology, Strategies, Scaffolds	*Motivating students to get involved in Sweet Hive Ventures can be achieved by highlighting various aspects that appeal to their interests, aspirations, and personal development:* *Engage in practical, experiential learning opportunities.* *• Students get to actively participate in beekeeping, honey extraction, and the creation of beeswax products, providing a tangible, and hands-on learning experience.* *Develop entrepreneurial skills and business acumen.* *• Students have the chance to learn about running a sustainable business, from product development to marketing, fostering a spirit of entrepreneurship.* *Contribute to environmental conservation and sustainable practices.* *• Understanding the vital role of bees in pollination and ecosystems, students become environmental stewards, promoting sustainability through beekeeping.* *Explore science, technology, engineering, mathematics, and entrepreneurship (STEAME) concept.* *• Beekeeping involves **biology** (study of bees), **mathematics** (data analysis), and **potentially technology** (monitoring hive conditions), offering a multidisciplinary STEAME* *Explore creative product development and innovation.* *• Designing and creating new honey and wax products allows students to express their creativity and innovation in a real-world business setting.* *Make a positive impact on the local community.* *• Participating in community engagement events, workshops, and initiatives allows students to contribute to the community and raise awareness about bees and sustainability* *Develop leadership skills and responsibilities.* *• Students can take on leadership roles within the program, leading teams, organizing events, and actively contributing to the success of Sweet Hive Venture.* *Build social connections and teamwork skills.* *• Collaborating with peers, educators, and community members fosters a sense of camaraderie and teamwork, creating a positive social environment.* *Experience personal growth and self-discovery.*

	• The diverse activities within Sweet Hive Venture provide opportunities for personal development, self-reflection, and the discovery of individual strengths and interests. *Involve parents in the learning process.* *•Parents can actively participate in workshops, community events, and even contribute their expertise, creating a supportive and involved community around the students.* *Engage in ethical and sustainable practices.* *• Students who are environmentally conscious and interested in ethical business practices find motivation in Sweet Hive Venture' commitment to sustainability and ethical beekeeping.* *Future Opportunities: Open doors to future educational and career opportunities.* *• Participation in Sweet Hive Venture can be highlighted on resumes and college applications, potentially leading to opportunities in environmental studies, business, or related fields.* *By emphasizing these motivations, Sweet Hive Venture can create a program that resonates with a diverse range of student interests, encouraging active involvement and a positive learning experience.* *To obtain the learning outcomes, it can be used project-based learning (PBL), in terms of developing critical thinking, problem-solving, and collaboration skills. The projects which we can develop might be* *1. Beekeeping and Sustainability Program* ● *Entrepreneurship: Business planning, marketing, and selling honey and wax products.* ● *Technology: Sustainable beekeeping practices, biodiversity conservation.* ● *Biology: Bee anatomy, life cycle, and pollination process* ● *Mathematics: Budgeting, cost analysis, and financial planning.* ● *Parents: Involvement through workshops, honey tasting events, and community engagement* *2. Mathematics and Data Analysis in Beekeeping:* ● *Entrepreneurship: Utilizing data for informed business decisions.* ● *Technology: Monitoring hive health through data analysis.* ● *Biology: Analyzing bee behavior and population trends.* ● *Mathematics: Statistical analysis, hive productivity calculations.* ● *Parents: Involvement in data collection and analysis workshops.* *3. Ethical Business Practices and Social Impact:* ● *Entrepreneurship: Integrating ethics into business decision-making.* ● *Technology: Measuring and communicating the environmental impact.* ● *Biology: Ethical considerations in beekeeping.* ● *Mathematics: Quantifying social and environmental impact.* ● *Parents: Participation in discussions on ethical business practices.*

4. Preparation and Means

Preparation, Space Setting, *Troubleshooting Tips*	*Classroom / APILab* *White boards and markers* *Double sided adhesive tape* *Laptop per student/LCD projector*
Resources, Tools, Material, Attachments, Equipment	*Instructional sources and digital material with the related references needed for the implementation of the learning plan:*

	Alexandru V. et al. Manualul apicultorului (ed 7)/ Beekeeper's Manual Romanian Beekeepers Association, 2002, https://apiardeal.ro/biblioteca/carti/Romanesti/Manualul_Apicultorului_Ed._07_de_A.C.A._322_pag.pdf ***, Beekeeping basics, https://denton.agrilife.org/files/2013/08/beekeeping-basics.pdf ***, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9110387/ *https://askabiologist.asu.edu/honey-bee-anatomy* *https://www.uaex.uada.edu/farm-ranch/special-programs/beekeeping/about-honey-bees.aspx* *https://www.uaex.uada.edu/farm-ranch/special-programs/beekeeping/BeekeepingBasics.aspx* *https://www.smartsheet.com/content/small-business-budget-templates*
Health and Safety	*Students and teachers work in a healthy and safe environment*

5. Implementation

Instructional Activities, Procedures, Reflections	*Lesson1 Increase Understanding of Bee Anatomy and Pollination (one hour)* *1. Teacher's Actions:* *Biology Teacher* ● *Conduct hands-on workshops where students can dissect model bees, providing a close-up look at bee anatomy.* ● *Engage students in discussions about the role of different body parts in the pollination process.* ● *Design interactive games or quizzes that challenge students to identify different parts of a bee and understand their functions.* ● *Incorporate technology, such as interactive apps or online platforms, to make the learning experience dynamic.* *Math Teacher* ● *Presents reviews graphical representation of data.* ● *Presents the astonishing Math Behind Honeycomb.* ● *Presents optimization methods.* *Entrepreneurship Teacher:* ● *Introduce the main entrepreneurial skills, business planning, and ethical business practices.* 2. Student Tasks ● *Analyze the bee anatomy.* ● *Identify the functions of the various parts of a bee.* ● *Make a chart with the main parts of a bee.* ● *Represents geometrical structures connected to Beehives.* *Lesson2 Foster Environmental Awareness and Conservation Practices (one hour)* *Biology Teacher* ● *Assign group projects where students develop and implement campaigns on environmental issues, such as plastic pollution or habitat conservation.* ● *Encourage creativity in designing posters, social media content, or short films to raise awareness.* *Math Teacher* ● *Engage students in developing cost analysis, and financial planning for a particular business.* *Technology Teacher* ● *Presents Beekeeping Technologies.*

Entrepreneurship Teacher

- *Introduce business simulation games that simulate the challenges and decision-making processes involved in running a sustainable business.*

2. Student Tasks

- *Discuss and understand the importance of environmental issues.*
- *Discuss and understand the importance of beekeeping technologies.*
- *Design a meaningful poster to underline the importance of plastic pollution or habitat conservation.*
- *Represent the budget and a cost analysis for a particular example.*
- *Understand the challenges and decision-making processes involved in running a sustainable business.*

Lesson3 Instill Entrepreneurial Skills and Ethical Business Practices (one hour)
Biology Teacher

- *Invite environmentalists, conservationists, or local experts to speak to students about the impact of human activities on the environment.*
- *Facilitate Q&A sessions to allow students to engage directly with professionals in the field.*

Technology Teacher

- *Discuss innovative technologies for bee life and for better beekeeping products.*

Entrepreneurship Teacher

- *Introduce business simulation games that simulate the challenges and decision-making processes involved in running a sustainable business.*
- *Emphasize ethical considerations, such as responsible sourcing and environmental impact, in the simulation.*

2. Student Tasks

- *Understand and discuss the impact of human activities on the environment.*
- *Understand and discuss ethical considerations, make a poster with the environmental impact.*

Lesson4 Beekeeping Projects (one hour)
Biology Teacher

- *Divide students into small groups and assign them responsibilities for managing a hive or specific aspects of beekeeping.*
- *Encourage collaboration in hive inspection, honey extraction, and other beekeeping activities.*

Entrepreneurship Teacher

- *Task students with organizing community engagement events, such as honey tasting fairs or educational workshops.*
- *Foster teamwork by assigning roles in event planning, promotion, and execution.*

2. Student Tasks
create multimedia projects related to bees, sustainability, and entrepreneurship, highlight the projects in school exhibitions or community events.

Lesson5 Projects in Beekeeping Entrepreneurship Innovation (2 hours)
Biology Teacher

- *Divide students into small groups and assign them responsibilities for the identification of currents methods to improve the bee life, sustainable beekeeping.*
- *Debates on climate change in the context of beekeeping entrepreneurship.*

Technology Teacher

- *Divide students into small groups to analyze advantages /disadvantages of different types of hives.*

	• *Discuss different tools/technologies in beekeeping and how other tools/technologies should improve productivity.* *Math Teacher* • *Debates on social life in apiary and optimization ways to increase the quality of life, productivity, and business.* • *Debates on modern tools for business analysis.* *Entrepreneurship Teacher* • *Task students with organizing community engagement events, such as honey tasting fairs or educational workshops.* • *Foster teamwork by assigning roles in event planning, promotion, and execution.* 2. Student Tasks • *Create multimedia projects related to bees, sustainability, and entrepreneurship, highlight the projects in school exhibitions or community events.* • *Create a web page/site to share their experience on beekeeping.*
Assessment - Evaluation	*Formative Assessment:* • *The teacher will check for understanding through classroom discussion. The teacher will help facilitate discussion and correct misconceptions, if necessary.* • *The exit ticket at the end of the lessons will help gauge student understanding.* • *The opening discussion will allow the teacher to check for understanding of the material as well as the end of class discussion about the results.* *Continuous formative evaluation involves:* • *Quizzes and Problem-Solving Exercises: Regular quizzes assessing knowledge of -* *- the role of different body parts in the pollination process.* *- about the impact of human activities on the environment.* *- about the beekeeping technologies.* *- the challenges and decision-making processes involved in running a sustainable business* *- designing a budget, cost analysis, and financial planning for a particular business* • *Group Presentation Rubrics*: Evaluating group presentations about the *pollination process and about the impact of human activities on the environment* focusing on accuracy in data representation, depth of analysis, and understanding of *this process.* • *Calculation Accuracy Checks*: Assessing the accuracy of calculations made during sessions related to *a budget, cost analysis, and financial planning for a particular business.* • *Peer and Self-Assessment: Encouraging students to assess their and their peers' work during group activities, fostering a reflective approach to understanding and teamwork.*
Presentation - Reporting - Sharing	*The results will be discussed by participating teachers, students, and other partners, will be published on the school website and on social media.*
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
   Introduce the participants and the objectives of the project on Beekeeping Safety and business empowerment.
2. Engaging the world of the wider environment / work / business / parents / society / environment/ ethics
   Brainstorming on bees, environment, beekeeping products, new products.
3. Target Age Group of Students - Associating with the Official Curriculum - Setting Goals and Objectives
   Identify the participants and their role in the project. Setting the goals and the steps to fulfill them. Discuss assessment criteria, ways of performance optimization and increasing proper learning in an interdisciplinary context.
4. Organization of the tasks of the parties involved - Designation of Coordinator - Workplaces etc.

Biology Teacher

- *Divide students into small groups and assign them responsibilities for the identification of currents methods to improve the bee life, sustainable beekeeping.*
- *Debates on climate change in the context of beekeeping entrepreneurship.*

Technology Teacher

- *Divide students into small groups to analyze advantages /disadvantages of different types of hives.*
- *Discuss different tools/technologies in beekeeping and how other tools/technologies should improve the productivity.*

Math Teacher

- *Debates on social life in apiary and optimization ways to increase the quality of life, productivity, and business.*
- *Debates on modern tools for business analysis.*

Entrepreneurship Teacher

- *Task students with organizing community engagement events, such as honey tasting fairs or educational workshops.*
- *Foster teamwork by assigning roles in event planning, promotion, and execution.*

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