GREEN AGRIPRENEURS OF FUTURE

STEM and AI THEME: SUSTAINABLE AGRICULTURE

STEM ACTIVITY PLAN TEMPLATE

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<tr><td>Country:</td><td>Poland</td></tr>
<tr><td>Teachers' Names:</td><td>Magdalena Grabowska-Hutek</td></tr>
<tr><td>Subject Title:</td><td>Hydroponic lettuce cultivation.</td></tr>
<tr><td>Learning Objectives/Goal:</td><td>• Understanding the basic principles of hydroponic vegetable cultivation.
• Acquisition of practical skills in the construction and operation of a hydroponic system for lettuce cultivation.
• Developing skills related to monitoring and controlling environmental parameters (pH, EC, humidity).
• To learn about the ecological benefits of hydroponic methods of growing vegetables.
• Improving teamwork and problem-solving skills during the creation and management of cultivation.</td></tr>
<tr><td rowspan="3">Related Outcomes:</td><td>Mathematics:

• Container volume: Calculate the volume of water or plant containers (e.g. calculate the volume of the water tank in which lettuce will grow, taking into account the shape of the container).
• Nutrient Concentration Calculations:
• Nutrient ratios, in this case, mathematical proportions can be used (e.g. calculating the amount of fertilizer to dissolve in a certain amount of water).
• Calculation of the concentration of the solution.
• Hydroponic system performance analysis.
• Calculating costs and economic efficiency</td></tr>
<tr><td>Information Technology (IT)

• Data monitoring and analysis systems: Using information technology to collect data on temperature, pH, humidity, nutrient levels, and other parameters in real time.
• Store and analyze this data to optimize the cultivation process.</td></tr>
<tr><td>Engineering:

• Hydroponic System Design: The ability to design and build hydroponic systems, such as NFT (Nutrient Film Technique) systems, aeroponics, and Wick systems. This can include the design of pipes, containers, pumps, water tanks, and irrigation equipment.
• Automation and monitoring: The use of technology in hydroponic systems such as pH sensors, humidity sensors, temperature sensors that allow automatic monitoring and adjustment of conditions for optimal plant growth.</td></tr>
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	• Energy management: Ability to calculate energy requirements, e.g. for LED lighting, ventilation, water pumps, and manage the energy efficiency of the system.
	Science: • Plant Physiology: Understanding plant metabolic processes such as photosynthesis, respiration, transpiration, and transport of water and nutrients. Knowing how plants respond to changing conditions such as light, temperature, humidity, nutrients is crucial for designing optimal conditions for lettuce cultivation. • Plant genetics: Understanding how different lettuce varieties differ in terms of growth, disease resistance, or nutritional requirements can help you choose the best varieties for hydroponic cultivation. • Plant pathology: Dealing with plant diseases in hydroponic systems, such as molds or fungi, and analyzing how to prevent and treat them.
	Other: • Project Management: Ability to manage a research or commercial project for hydroponic lettuce cultivation, including planning, budgeting, team collaboration, and communication of results. • Education and public awareness: Exploring the social and educational aspects of hydroponic crop production, including popularizing this technology as a solution in cities (urban farming)
Grade:	7th class
Duration:	90min
21st Century Skills:	• Critical thinking and problem solving: analysis of crop problems, adjustment of system parameters. • Collaboration: Teamwork to build the system and monitor crops. • Communication: presenting the results of work in the form of presentations, discussing the results with classmates. • Technical skills: design and construction of a hydroponic system, operation of tools and equipment related to cultivation. • Project management: planning activities, dividing tasks into groups, controlling the progress of work.
Learning Approach:	✓ An experiment-based and experiential approach (Learning by Doing) ✓ Research and analytical approach ✓ Design and innovation approach ✓ Interactive approach and collaboration ✓ Technology-driven approach ✓ Observation and reflection approach ✓ Sustainable and ethical approach
Duties (Student and Teacher roles):	The teacher acts as a guide and directs the students by asking them questions. On the other hand, students take on the role of researchers,

	question the topic and its effects, and create their own projects, developing proposals for solutions.
Materials and Technologies to use:	PVC pipes tools (saws, hammers, nails, soldering irons) temperature meters, PH air pump tablets lettuce seeds fertilizers
Lesson Plan According to 5E Learning Model	1. Engage – 10 minutes Objective: To inspire participants, arouse interest in the topic of hydroponics and introduce the topic. • Presentation: At the beginning of the class, the teacher presents a multimedia slide in which he introduces the basics of hydroponics, its history and its importance in today's urban and sustainable agriculture. • Topics to be discussed: about What is hydroponics? o What are the differences between traditional agriculture and hydroponic farming? o Why is hydroponics the future of urban farming? o What are the advantages (water savings, space savings) and challenges of hydroponics? • Questions for participants: "Have you heard of hydroponics? What plants do you think might be best grown in a hydroponic system?"
	2. Explore – 20 minutes Objective: To encourage participants to discover on their own the practical aspects of building a hydroponic system and the first steps in lettuce cultivation. • Hydroponic System Presentation: o The teacher shows the elements of the hydroponic system: water containers, pumps, pipes, LED lighting, growing medium – expanded clay). o System structure: ♣ Participants, in groups, build a simple NFT system). The teacher demonstrates how to connect the elements of the system and discusses the principles of their operation. ♣ Practical classes: Preparation of the system, installation of the aerator, pipes. • Planting lettuce: o Participants place lettuce in the system so that the roots have access to the nutrient solution.
	3. Explain – 20 minutes Objective: To understand the process of lettuce cultivation, the role of the hydroponic system and the principles of fertilization and monitoring of plant growth. • Overview of the operation of the hydroponic

	system: o The teacher explains in detail how the hydroponic system works: how the water with the nutrient solution flows through the roots of plants, how important parameters such as pH and EC (electrical conductivity) are. o Explains the principles of fertilization in a hydroponic system, as well as the role of various nutrients (nitrogen, phosphorus, potassium) in plant development. • System Parameter Management: o Introduction to water pH, temperature and EC monitoring – the teacher shows how to use tools to measure these parameters. o A brief discussion of the impact of these parameters on lettuce growth. • Analysis of future fertilization after 14 days: o Fertilization calculations – participants calculate what changes in fertilization will be needed in the second stage of cultivation (after 14 days), based on the results of pH and EC measurements. Discussion on the need to adapt the fertilising solution to the growth phase of the plants (e.g. more nitrogen in the initial growth phase).
	4. Elaborate – 20 minutes Objective: To develop participants' knowledge of the optimal conditions for lettuce growth and the effectiveness of their hydroponic systems. • Practical system management: o Participants in groups carry out a simulation of monitoring a hydroponic system. They have to control the water parameters (pH, EC, temperature, water level). o Joint analysis of results and exchange of experience: Which systems work best? What problems were encountered? • Fertilization planning: o Participants calculate what nutrients they will need in the next stages of cultivation. o Discussion of possible fertilization problems (e.g. excess nutrients, improper pH level).
	5. Evaluate – 20 minutes Objective: To assess participants' understanding of the lettuce growing process and the effectiveness of their work in a hydroponic system. • Discussion and analysis: o Participants evaluate the effectiveness of their hydroponic system and the correctness of fertilization assumptions. o The teacher asks control questions: ♣ What factors can affect plant health and growth in a hydroponic system? ♣ What challenges did you encounter while building

	the system? ♣ What are the possible fertilization errors and how to solve them? • Summary of results: o Participants present their conclusions about the project (e.g. how to improve the efficiency of cultivation, what changes should be made in the system). o Open-ended questions: What can be done to improve the efficiency of the hydroponic system in the future? What other crops could be grown in such a system?
	Conclusion • Summary of the class: A short summary of the main issues raised during the class (system construction, fertilization, monitoring parameters). An encouragement to continue working with the system and observing the growth of lettuce. • Homework: Participants can prepare a report on the further development of their crop, monitor the plants over the next days and analyze the effectiveness of fertilization.
Related Resources:	multimedia presentation Canva Mentimeter AI
References:	