Introduction to Aquaponics

Overview Introduction to Aquaponics is offered to middle school students at the sixth-grade level. as a general elective. This year long problem-based course promotes understanding of foundational science standards, math skills, engineering design process and lab techniques used in a lab setting. Students will use problem-based learning to explore raising fish and growing plants in the same system then marketing and selling the product locally. Students will learn the basics of water chemistry and plant/ fish biology, data management, nutrition, food safety and research and development in the process.

Objectives

- Develop lab technique and soft skills need to work in a laboratory setting.
- Use the edp to trouble shoot the Aquaponics system and find solutions to research questions.
- Lean the needs of fish and plants in relation to one another. Understand plant and fish physiology.
- Understand and identify common diseases and pests for fish and plants grown in Aquaponics, and their treatment.
- Market and brand their plant and fish products.

Assessment Students will be assessed using projects throughout the class, exams, and daily/ weekly assignments.

Course Essentials

Equipment	Cost/Unit
Software	$0 (Required).
Computer or laptop	
Other Materials	Reusable: $10,000 + per unit Consumable: (up to $1000 per year, replace as needed)

Outline:

Unit 1: Introduction to Aquaponics	Investigate the origin and history of aquaponics. Develop science inquiry skills and practice experimental design, Familiarize students with basic lab techniques and the importance of biosecurity.
Unit 2: Introduction to the System Design and Function	Identify the key components of the Nelson- Pade Aquaponics System. and explain the function and importance of each part of the system. Focus on the clarifier, water and air flow, the purpose of the aeration system, its design, and plumbing. Standard operating procedures practiced.
Unit 3: The Nitrogen Cycle/ water testing and quality control.	The nitrogen cycle, its importance, major parts of the cycle. Water quality requirements for aquaponics and water testing. Lab techniques and lab roles/ skills utilized. Titration, calculations, chemical reactions.
Unit 4: Introduction to Fish Characteristics, Health, Stress, and Acclimation	Identification of fish, common stressors, and health requirements. Common fish diseases introduced. Using a scale, Data inputing and graphing, metric conversions
Unit 5: Introduction to Plants	Plant selection, seed germination techniques, tracking growth, and harvesting. Data inputting and graphing more than 1 set of data.
Unit 6: SOPs and Lab Responsibilities	Students identify standard operating procedures in the lab and what each lab roles responsibilities are. Managers develop their teams and supervise work, developing group collaboration skills, reporting results and problem solving
Unit 7: Plant nutrition, testing, and disease	Macronutrients, micronutrients, extraction, nutritional needs, tesing, and common plant disease identification and treatment
Unit 8 Plant Parts, Functions and Reproduction	Identification of plants and their parts, common stressors, health requirements. Plant reproduction forms.
Unit 9 Fish Anatomy and Physiology	Identification of Fish and their parts including function.,
Unit 10 Algae, microscopic organisms, and pests	Single and multicelled organisms identification and function. What is a pest? How microscopic organisms can impact the health of your fish and plants.
Unit 11 Branding, Marketing	Students develop a marketing plan for their product, including branding, packaging, and marketing in the community.
Unit 12 Engineering and Design	Students use the EDP to resolve problems that develop in their aquaponic components and design engineering solutions to problems they choose to research.

AQUAPONICS DESIGN (Pilot)

1. Materials
   Internet access, one-to-one computer use daily, and access to the LSU servers.

Hardware/Reusable Material	Recommended Unit	Cost/Unit
Aquaponics Equipment- suggested unit Nelson and Pade	1-2	$10,000.00-$20,000.00
Consumables		$1500.00
Chemistry water testing kits		
Water treatment chemicals		
Food pellets		
Miscellaneous materials for research projects		
Microscope		

2. Required software, networking access, and access to LSU servers
   a. Students will need to sign up with online development and testing environments.
   b. Students will need access to YouTube instructional videos relevant to the course, as well as other educational video repositories.
   c. Teachers will need to be able to access the LSU servers using several Internet protocols including but not limited to HTTPS and SSH.
   d. Students and teachers will access the curriculum and teaching materials through the LSU and through Google Drive.
   e. Teachers will need to share sample student work with their designated LSU Pathway Point-of-Contact.
   f. Principals will need to communicate with the district's information technology department to ensure that there are no technological restrictions that block access to the LSU servers in the lsu.edu, college-readiness.lsu.edu or stempathways.lsu.edu domains on any port.
3. Required teacher collaborations
   Teachers will communicate with LSU instructors via emails, apps hosted on the LSU servers, and the band.us app. Teachers will need to share sample student work with their designated LSU Pathway Point-of-Contact.
4. Required administration of course content, pre/post test, and research instruments
   All required materials and instruments will be either posted in the LSU servers, Google Drive, or their location announced via email.
5. Course Work
   Teachers must present the course material in sequence or as approved by collaboration with the LSU Pathway Point-of-Contact. Teachers are expected to deliver a minimum of 80% of the course material.
6. Other
   As this is a project-based learning class, we strongly suggest that each section of the course be limited to a *maximum* of 20 students in order for them to receive adequate instruction.