Georgia NASEF Farmcraft® 2024 Project Based Learning:
Preseason Challenge #2: Controlled-Environment Agriculture

Overview:

In this Project Based Learning (PBL) lesson, students will be tasked with researching how to grow food in non-traditional ways. Students will investigate the different methods utilizing soilless agriculture. Students will then present their learning by building and sharing a Minecraft world that displays and demonstrates their understanding and educates others on vertical farming and aquaponics.

Focus Standards:

- NGSS Standards
    - MS-ESS3-2 Earth and Human Activity – Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
    - MS-ESS3-5 Earth and Human Activity – Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

- ITTEA Standards for Technological and Engineering Literacy –
    - STEL-1Q - Conduct research to inform intentional inventions and innovations that address specific needs and wants.

- ISTE Standards –
    - 3 Knowledge Constructor – Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.
    - 6 Creative Communicator – 6c Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models, or simulations.
    - 7 Global Collaborator – Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

- Georgia Agriculture Standards –
    - AFNR-AQU-3 – Identify and describe trends in the aquaculture industry.
    - AFNR-AQU-4 – Classify the scientific principles involved in the production of aquatic animals and plants.
    - AFNR-PSB-18 – Evaluate environmentally controlled plant growth systems.
    - AFNR-PSB-19 – Analyze the effect of plant production on the environment.

Objectives:

- Students will research both economic and environmental advantages and disadvantages of controlled environment systems.
- Students will investigate how to set up a vertical farm and aquaponics system.
- Students will design a Minecraft world that educates others on the requirements for a successful controlled growing environment.

Requirements/Task(s):

- Task 1: Complete a K-W-L chart (example provided below) of how controlled-agriculture can benefit both the environment and economy in Georgia.
- Task 2: Research the challenges behind constructing a vertical growth system.
- Task 3: Build, narrate, and submit a Minecraft world that demonstrates learning and displays and demonstrates their understanding and educates others on creating a controlled growing space that includes vertical farming and aquaponics.

Procedure:

1. Students will tune into the livestream or watch the recording of the NASEF Farmcraft 2024 livestream, "**GA NASEF Farmcraft 2024 Preseason Challenge #2**." It is recommended that the team sponsor/educator watch with the students.
   a. Tuesday, February 27, 2024 @| 3:00pm ET
   b. Livestream and recording YouTube playlist link

2. **Present the challenge to the students:**

Pre-Season Challenge 2: Controlled-Environment Agriculture

The population continues to rise, yet the amount of arable land available for food production is decreasing. Therefore, there is a growing need for innovation in maximizing space for growing greens and proteins at higher yields, while mitigating environmental impact.

Research the types of indoor grow units currently on the market that utilize soilless agriculture. How can aquaponics be used as a source of protein in these environments? Build, narrate, and submit a Minecraft world that demonstrates your learning, displays your understanding, and educates others on vertical farming and aquaponics.

Some questions to consider when researching and developing your build:

What is controlled-environment agriculture?

What are advantages and disadvantages to vertical farming?

How does aquaponics work, what are the different design options?

What edible, Georgia-native, fish species for your aquaponics operation?

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Considering the questions above, **guide the students through the "K" and "W" portions of the K-W-L** chart. K-W-L charts are graphic organizers that guide students through organizing information before, during, and after a unit, project, or a lesson. They can be used to engage students in a new topic, activate prior knowledge, share unit objectives, and monitor students' learning.

Ask students what they KNOW (or believe they know) This information may be incorrect, inaccurate, or misinformed. For this step of the process this is acceptable as their learning and research should be utilized to address misconceptions.

Ask student what they WANT to learn (or need to learn to effectively complete their project).

Learn more about K-W-L charts here: https://www.lucidchart.com/blog/what-is-a-kwl-chart

K-W-L Chart		
Topic:		
What I **KNOW**	What I **WANT** to Learn	What I **LEARNED**

3. **Guided student research**

   Students will investigate and explore the information necessary to complete their project based on their responses to the first two columns of the K-W-L chart.

Controlled Growing Environments/ Vertical Farming:
- https://www.usda.gov/media/blog/2018/08/14/vertical-farming-future
- https://cea.cals.cornell.edu/about-cea/
- https://www.perchenergy.com/blog/innovation/what-is-vertical-farming-how-it-works
- https://www.danthermgroup.com/en-gb/calorex/why-controlled-environment-agriculture-cea-is-the-future-of-farming
- https://foodinsight.org/controlled-environment-agriculture/
- https://attra.ncat.org/publication/vertical-farming/

Aquaponics:
- https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/aquaponics
- https://www.youtube.com/watch?v=yhcAOE2JOVs
- https://www.fao.org/3/i4021e/i4021e.pdf (scroll to pg 271 for the quick reference
- https://www.permaculturenews.org/2016/05/30/what-is-aquaponics-and-how-does-it-work/
- https://georgiawildlife.com/aquaculture#definitions
- https://nativefishcoalition.org/georgia
- https://lgpress.clemson.edu/publication/aquaponics-system-layout-and-components/

Have students share their resources and findings. **Guide the students through completing the "L" portion of the K-W-L** chart. This should serve to inform their choices in their builds.

4. **Project Build:**

Review the challenge with the students.

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Students will work together with their team to complete the challenge in Minecraft Education Edition. Use this time to remind students to refer to their K-W-L chart to ensure they are including the information and discussion points they have discussed.

For technical support and regarding the use of Minecraft Education Edition for the challenge, please see the Using Minecraft: Education Edition NASEF Farmcraft Guide: https://www.nasef.org/media/3678/nasef-farmcraft-using-minecraft-education-edition.pdf

5. **Submission:**

To submit their projects, guide students to the NASEF Farmcraft 2024 Flip: https://flip.com/962a73de and select Preseason Challenge #2

Before submission, students should be asked to consider the following regarding their videos:

o   Make sure we can see what you are showing us.
o   No shaking: Consider the viewer. Are you keeping the "camera" steady?
o   Can we hear you? Is the audio clear?
o   Make sure to have the team's name in the title of the Flip submission

Special thanks to the consultants on this challenge, Shan Arora, Director of Kendeda Building, and Professor James Shelton, Warnell School of Forestry-Fisheries and Aquaponics at the University of Georgia.

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K-W-L Chart

Topic:

What I **KNOW**	What I **WANT** to Learn	What I **LEARNED**