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| **Lesson Plan for Grades:** 10+  **Length of Lesson:** 90 min |
| **Authored by:** UT Environmental Science Institute  **Date created:** 2/12/2024 |
| **Subject area/course:**   * Environmental Science |
| **Materials:**   * Student devices (with internet connection) * Foot Footprint handout (physical or digital copy) |
| **TEKS/SEs:**  **§112.37. Environmental Systems**  (5) Science concepts. The student knows the interrelationships among the resources within the local environmental system. The student is expected to:   * (A) summarize methods of land use and management and describe its effects on land fertility.   (9) Science concepts. The student knows the impact of human activities on the environment. The student is expected to:   * (F) evaluate cost-benefit trade-offs of commercial activities such as municipal development, farming, deforestation, over-harvesting, and mining. * (J) research the advantages and disadvantages of “going green” such as organic gardening and farming, natural methods of pest control, hydroponics, xeriscaping, energy-efficient homes and appliances, and hybrid cars. |
| **Lesson objective(s):**   * Student will be able to...   + Analyze the environmental emissions associated with various food items.   + Evaluate the impact of the food system on the environment and greenhouse gas emissions.   + Summarize methods of land use and management and articulate their effects, particularly in relation to food production.   + Assess the cost-benefit trade-offs of commercial activities on the environment.   + Propose and discuss alternative behaviors and practices that can reduce the negative environmental impact of the food system. |
| **Differentiation strategies to meet diverse learner needs:**   * The teacher should ask students whether they prefer to read or watch videos to learn about concepts; then have students learn in their preferred learning style. However, the teacher may assign students certain methods to improve their skills. For example, if a student prefers reading, teachers may have them watch a video and take notes to improve their listening skills. * ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration. |
| **ENGAGEMENT (10 minutes)**   * During this portion, the instructor will begin by asking students what their favorite foods are, sparking a discussion about a topic that could interest students and connection to the broader implications of food choices on the environment and food security. * Students will be invited to reflect on their answer to the initial topic of their favorite food, and the implication that what we eat and how its produced has an impact on the world around us. |
| **EXPLORATION (35 minutes)**   * Students will engage in a “Food Footprint” activity where they will calculate the environmental footprint of various food items. * Questions for students to explore:   + How do different food choices impact the environment? Consider different factors such as water usage, carbon emissions, land use, etc.   + How does a change in diet affect someone’s environmental impact? Consider dietary choices such as eating organic or abstaining from animal products.   + How would organic farming compare to conventional farming in terms of environmental sustainability?   + What are some strategies for reducing the environmental footprint of our food choices? |
| **EXPLANATION (20 minutes)**   * Students will engage in a [jigsaw](https://www.readingrockets.org/classroom/classroom-strategies/jigsaw) where they present their food footprints and explore their peers’ findings. Each student group will have calculated the environment footprint for their different food item. * Jigsaw:   + A member of each student group will remain at their original table, while one of each other member goes to join another group’s table.   + Each group-representative at a table will take turns presenting their group’s findings, explaining their work and the food assigned to them, and the calculations they produced.   + After each presentation, students will have the opportunity to ask questions and engage in discussions with their peers about the environmental impact of each food.     - Encourage students to engage in discussions with eachother by asking questions such as:       * “What were the main factors contributing to the environmental footprint of your assigned food?”       * “Do any of these factors surprise you?”       * “What are some strategies for reducing the environmental impact of this food choice, or is this food environmentally-conscious as it is?”     - Prompt students to dig deeper and justify their findings:       * “Why do you think certain foods have a large environmental impact than others?” * Higher-Order Thinking Questions:   + How do the findings from your food footprint activity align with the broader concept of sustainability in the food industry?   + What are some potential implications of the environmental footprints of different foods for global food security and protecting the environment?   + How can individual dietary choices contribute to or mitigate the impact of food production on the environment?   + What are the ethical considerations associated with food production methods and their environmental consequences?   + How might lawmakers and companies use information about food footprints to inform decisions about sustainable food production and consumption practices? |
| **ELABORATION (25 minutes)**   * The instructor will begin this section by presenting to students a clip from Dr. Patel’s talk in which he discussed the “true expense” of the food industry, timestamp (3:50 – 8:40). * Following the video, prompt the students to discuss some of the following questions:   + What were some of the key points Dr. Patel made in this segment about the environmental impact of the food industry?   + Were there any statistics or examples from the talk that surprised you or challenged your preconceptions about the food industry?   + How can we use the information presented in the talk and what we’ve learned about the “true cost” of food to inform our personal choices and actions in regard to consumption?   + In what ways can individuals, communities, and governments address some of the issues that Dr. Patel raised to promote more sustainable and equitable food systems?   + What are some of the potential challenges or barriers to implementing solutions to mitigate the environmental and social impacts of the food industry? * After watching and discussing Dr. Patel’s talk, students will engage in a reflective activity where they revisit the favorite food they selected at the beginning of the engagement.   + Guided Reflection:     - Students will spend a few minutes individually reflecting on the following questions in a journal or on a blank sheet of paper:       * What are the main ingredients in your favorite food?       * Where do these ingredients come from, and how are they produced?       * What environmental resources are used in the production, transportation, and preparation of your favorite food?       * How might the production and consumption of your favorite food contribute to environmental degradation: deforestation, habitat loss, water pollution, water usage, greenhouse gas emissions, soil degradation, etc.       * Are there any social consequences associated with the production and/or consumption of your chosen food? Examples: labor exploitation, community displacement, unequal access to nutritious food, etc.       * Consider what we’ve discussed in regard to sustainability and the impact of the food industry on the world around us. What are your thoughts on the true cost of your favorite food?       * What are some ways that the true cost of your chosen food might be mitigated? * As a final activity, allow students to discuss their thoughts on the true cost of their favorite food within their small groups, and any lingering questions they may have about food sustainability and environmental impact. |
| **EVALUATION (throughout entire lesson)**   * Instructors may collect the Food Footprint handout or the written reflection from students on the true cost of their favorite food as artifacts from the lesson. * An additional reflection discussion may be held at the end of the lesson (time allowing) in which students share their findings on the true cost of their favorite food with the class at large rather than just in their small groups. |
| **SOURCES AND RESOURCES**   * List any sources you referenced to create this lesson plan, and if relevant, include the full web addresses for them. * **Dr. Raj Patel’s *Hot Science – Cool Talks #128,* “Recipes for Food Insecurity”,** <https://www.esi.utexas.edu/talk/recipes-for-food-insecurity> * [Slide Deck](file:///C:\Users\Newt\Downloads\Brown%20Orange%20Creative%20Fun%20Illustration%20Sustainable%20Food%20Business%20Presentation.pptx) * [Food Footprint Handout](file:///C:\Users\Newt\Downloads\Food%20Foot-2.pdf) |

Additional resources

* <https://www.seattleschools.org/wp-content/uploads/2022/03/AVID_Instructional_Strats.pdf>

**ENGAGEMENT ACTIVITY**

**Purpose:** To prepare/”warm-up” students to discussion that will occur throughout the lesson, and to serve as a fun and relatable question that each student can answer and be willing to share with others, as well as a segue into the discussion of food and sustainability.

**Materials:** N/A

**Safety Information**: N/A

**Procedure:**

* Introduction:
  + Instructor will begin by greeting students and posing the following question for discussion: **“What is your favorite food?”.** Allow a few minutes for students to think over the question to themselves, before encouraging students to raise their hands and share their favorite food or dish. This should serve to capture student interest and warm them up for the discussion that will happen throughout the lesson.
* Interactive Discussion:
  + Engage with the students’ responses by asking follow-up questions. These may include inquiries such as:
    - Why is that your favorite food?
    - Where does that food come from?
    - How is that food made? (produced, cooked, grown, etc.)
    - What does it “cost” to make that food?
  + From here the discussion should transition towards the main focus of the lesson, how the “cost” of producing food might be rather different than we thought initially.
* Questions for Student Reflection:
  + “Where does my favorite food come from?”
  + “What are the environmental impacts associated with its production?”
  + “Are there alternative food choices that may be more sustainable?”

**EXPLORATION ACTIVITY**

**Purpose:** The purpose of the “Food Footprint” activity is to help students understand and quantify the environmental impact of various foods they encounter regularly. Through this activity, students will explore how different food choices can affect factors such as water usage, carbon emissions, and land use. They will also examine the potential environmental benefits of dietary changes, such as choosing to eat local or eat plant-based foods and consider strategies for reducing the overall environmental footprint of their food choices.

**Materials:**

* Devices available for student use with connection to the internet.
* Food Footprint handout (available below), either in physical or digital form.
* The Our World in Data Food-Emissions website (<https://ourworldindata.org/grapher/food-emissions-supply-chain>)
* Calculators or a similar application

**Safety Information**: N/A

**Procedure:**

1. Introduce the activity and distribute the Food Footprint handout.
2. Allow students time to read through the activity instructions and the brief explanations of greenhouse gases and CO2e.
3. Students will navigate to the *Our World in Data* website using the link (<https://tinyurl.com/owidfood>) and explore the *OWID* dataset. Students will be responsible for selecting a multi-ingredient food or recipe that they are familiar with and, using the *OWID* data, will calculate the total carbon footprint for their food using the carbon emissions data of its ingredients.
4. After calculating the carbon footprint of their food, advise students to fill in the Food for Thought portion fo the handout, as their responses there will be helpful when it comes time for them to share their findings with their groups in the Jigsaw portion.

**ELABORATION ACTIVITY**

**Purpose:** The purpose of the jigsaw activity is to deepen students’ understanding of the impact of food on the environment and the ways that we could mitigate that impact by engaging in discussion. Through this activity, students will present their findings from the Food Footprint activity, explore their peers’ findings, and engage in meaningful dialogue to analyze the environmental impact of food and the strategies for reducing the footprint of the foods we eat by exploring broader concepts like sustainability.

**Materials:**

* Food Footprint handout from the previous activity.

**Safety Information**:

* Ensure a respectful and inclusive environment for discussions where students feel comfortable expressing their opinions and asking questions.
* Encourage constructive dialogue and remind students to listen actively to their peers.

**Procedure:**

1. Introduce the jigsaw activity and divide students up into new groups.
2. Instruct students to take turns presenting their findings, explaining the food they chose and why, the calculations they performed, and the factors that contributed to their food’s footprint.
3. After each presentation, facilitate discussions among students by asking guiding questions (questions students will have answered in the Food for Thought portion of the handout):
   1. What were the main factors contributing to the environmental footprint of your food?
   2. Do any of these factors surprise you? Why or why not?
   3. What are some strategies for reducing the environmental impact of this food choice, or is this food environmentally-conscious as it is?
4. If discussion finishes early, prompt students to justify their findings and engage in questions such as:
   1. Why do you think certain foods have a larger environmental impact than others?
   2. What are some implications of the environmental footprints of foods for global food security and protecting the environment?
   3. How can individual dietary choices help or hurt the environment?
   4. How might lawmakers and companies use information about food footprints to inform decisions about sustainable food production and consumption practices?
5. Encourage active participation and collaboration among students throughout the jigsaw activity.
6. Conclude the activity by asking students to share some of the things discussed in their group, particularly if they gained any new insights.