Module 3: Cucumber Module

**Driving Question(s)**

Driving Question: How can we produce crops outside all year long?

Examples of Sub-Driving Questions:

* How can we design and construct a trellis for the cucumbers?
* What data should be collected about our plants and how can we organize it?
* Why might it be better to direct seed or transplant crops?

**Overview**

In this module the students explore gardening up close as they grow cucumbers in the classroom. This allows students to study the daily growth of these cucurbits. This will help the students prepare for the summer garden.

This module is a great one to start when you are trapped inside with the cold weather. Because this module takes place inside it can be done at any time of year. If you are planning on completing the summer module (module 4) it would be best to start this no later than the middle of February.

**Major Products & Performances**

Lesson 1: Science Notebook

Lesson 2: Completed Earthbox

Lesson 3: Daily Log and Measurements

Lesson 4: Trellis Design

Lesson 5: Paragraph in Science Notebook

Other: Cucumber Garden Indoor and Pickles

**Teacher Background**

About the plant:

Cucumbers mature quickly and can be grown in small areas if trellised. Cucumbers are grown for slicing or pickling. This module uses the cucumbers for pickling. Because we are growing them indoors it is recommended that you select greenhouse varieties. These types do not require hand pollination. Some examples of varieties are miniature white cucumbers, harmonie, excelsior and H-19 Little Leaf.

Pickling cucumbers grow to be 3- 4 inches long versus the 6-8 inch slicing cucumbers. Harvest the cucumbers when they are green and the desired size; do not wait until they are yellow.

For more information visit: <http://aggie-horticuluture.tamu.edu/vegetable/flies/2010/10/E-507_cucumbers.pdf>

Setting up the Garden Bed:

Before planting make sure that the soil is moist but not wet.

For more information on starting a garden visit: http://anr.ext.wvu.edu/lawn\_garden/start\_a\_garden

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| Title | Lesson 1: Direct Seeding Verse Transplanting |
| Overview | Students will grow seedlings on a heat mat to prepare for transplanting. Then the students will compare these plants to the seed that direct seed into the EarthBox. The students will be able to compare and contrast the results to determine which way they think was more effective in producing a larger harvest.  Duration: Ongoing throughout the entire module |
| Standards | Science:  4-LS1.1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.  Science and Engineering Practices:   1. Asking questions and defining problems. 2. Planning and carrying out investigations. 3. Analyzing and interpreting data. 4. Using mathematics and computational thinking. 5. Constructing explanations and designing solutions. 6. Engaging in argument from evidence. 7. Obtaining, evaluating and communicating information   21st Century Skills: 21C.O.3-4.1.LS.1  Student identifies information needed to solve a problem or complete an assignment, conducts a search and prioritizes various sources based on credibility and relevance, retrieves relevant information from a variety of media sources, and uses this information to create an effective presentation.  21st Century Skills: 21C.O.3-4.1.LS.3  Student articulates thoughts and ideas accurately and effectively through oral, written or multimedia communications.  21st Century Skills: 21C.O.3-4.2.LS.1  Student engages, with teacher assistance, in a critical thinking process that synthesizes knowledge and ideas.  21st Century Skills: 21C.O.3-4.2.LS.3  Student engages in a problem solving process that promotes questioning, planning investigations and finding answers and solutions.  21st Century Skills : 21C.O.3-4.3.LS.4  Student appreciates, accepts, and works cooperatively with others, in both academic and social contexts, shares responsibility for continued improvement of the academic performance and climate of the school, and exhibits ethical behavior while working alone or communicating with others. |
| Materials/Advance Preparation Needed | Materials:   * Heat Mat, * Grow lights, * EarthBox, * soil * standard flat (tray with no holes for the pots or plugs), * little plastic pots for seed germination, * Cucumber seeds, greenhouse variety (miniature white cucumber, harmonie, excelsior, H-19 Little Leaf are some examples of pickling cucumbers)   Advanced Preparations: Collect materials |
| Procedures/Steps:  (Emphasis on students making inquiry, e.g., posing questions/problems and working towards answers and solutions) | Review with students what they planted in the last two modules (radishes and winter greens). Introduce the cucurbit family (family of plants including melon, pumpkin, squash and cucumbers) and explain that students will be learning about gardening up close as we grow cucumbers in the classroom.  Explain to students that we are going to experiment and see if it makes a difference to direct seed or transplant the crops (this can be used to get a head start on the summer garden later this year). Review with students the scientific process and use the terms to help students through this process.  Ask a Question: Will more cucumbers be produced if the plants are direct seeded or transplanted?  Research: Review the following websites about growing cucumbers  Purdue University: [www.hort.purdue.edu/ext/ho-8.pdf](http://www.hort.purdue.edu/ext/ho-8.pdf)  Texas A&M: <http://aggie-horticulture.tamu.edu/organic/files/2011/03/E-507_cucumbers.pdf>  (University Extension Services are a great place to get background information)  Hypothesis: Have students write their hypothesis in their science notebook. Ask the students how we will determine which type did the best? (size, number of flowers, number of cucumbers, biggest cucumbers, etc.)  Test Hypothesis:  Preparing Seedling: Use small pots that will fit into a standard flat. Have students work in pairs to plant two seeds into each pot. Ask students why we might be planting more than one seed in a pot (to increase our chances of success). What can they do if both seeds start to grow (pinch out the weaker plant to allow the stronger one enough space to grow). Ask: Why might we plant more seedlings than will fit into the Earthbox? Do not pack the soil and make sure to water the seeds after they have been planted. Then place the pots in the standard flat that should be on a heat mat and under the grow lights. Make sure the grow lights are place about an inch from the top of the pots in order to warm the soil. Water and check daily. Once the plants sprout you can remove the heat mat. Leave plants under the grow lights until they have a few (2-3) leaves. At this point the plants are ready to be transplanted. |
| Procedures/Steps (continued) | \*\* Complete lesson 2 on preparing the EarthBox before transplanting\*\*\*  Transplanting and Direct Seeding: Get an EarthBox with soil and divide it in half (or use two separate EarthBoxes, if they are available). On one side the class will direct seed some of the cucumbers. One the other side the students will transplant some of their most successful seedlings (no more than 4).  Analyze and Collect Data: See Data Log Lesson  Then have the students draw conclusions based on their data.  Communicate Results: Have a class discussion about the results and the students conclusions. Which plant did better? Why do you think that was? Did it make a difference if we direct seeded or transplanted? Why? How might we use this information in the future? |
| Assessment (What will be the evidence of student learning?) | The students will be assessed as they participate in class discussions related to the science and engineering practices they will use to set up their experiment. The students will also be assessed in their participation planting the seeds. |

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| Title | Lesson 2: Setting up the EarthBox |
| Overview | The students will set up their EarthBox. Students will work collaboratively to complete this task.  Duration: 1 day |
| Standards | Science and Engineering Practices: Asking questions and defining problems; Using mathematics and computational thinking; Obtaining, evaluating and communicating information  Math: M.4.OA.3: solve multi-step word problems posed with whole number and having whole-number answers using the four operations, including problems in which remainders must be interpreted, represent these problems using equations with a letter standing for the unknown quantity and assess the reasonableness of answers using mental computations and estimation strategies including rounding.  M.4.MD.1: know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec, within a single system of measurement, express measurements in a larger unit in terms of a smaller unit, record measurement equivalents in a two column table, (For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in.) and generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36)  M.4.MD.2: use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects and money, including problems involving simple fractions or decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit and represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.  M.4.MD.3: apply the area and perimeter formulas for rectangles in real world and mathematical problems.  21st Century Skills : 21C.O.3-4.3.LS.4  Student appreciates, accepts, and works cooperatively with others, in both academic and social contexts, shares responsibility for continued improvement of the academic performance and climate of the school, and exhibits ethical behavior while working alone or communicating with others. |
| Materials/Advance Preparation Needed | Materials:   * Measuring Tap and rulers * String * Tape * EarthBox kit * Soil * Popsicle Sticks to use a markers * Permanent Markers * Copies of EarthBox manual (enough for students to read with a partner) * Seed packets   Advanced Preparation: Copy the instruction from the EarthBox manual, collect the materials and have them ready for the students to use, have seed packets for students to reference |
| Procedures/Steps:  (Emphasis on students making inquiry, e.g., posing questions/problems and working towards answers and solutions) | Show the students an empty EarthBox and ask them how they think it will work. Have a discussion about why it is good to use an EarthBox for indoor gardening. Compare the EarthBox to the raised garden bed outside.  Pass out the EarthBox instruction manuals and have students read it with a partner. Have students discuss with their partner the steps to planting in EarthBox. Then have 2 or 3 pairs work together in a small group and use the manual to estimate how much soil they think they will need to fill the EarthBox. Allow students to take measurements to help with their estimation. Ask students how this relates to area and perimeter (this can be a good time to introduce the students to volume).  As a class come up with a procedure for preparing the EarthBox. Use this procedure to assign groups a role in helping to prepare the EarthBox (some groups might be helping to transplant or direct seed –refer to lesson 1). Then allow students time to work on preparing the EarthBox. It is best to have one group working on the EarthBox at a time because of the limited space. |
| Assessment (What will be the evidence of student learning?) | Students will be assessed in their use of math and following directions to complete the EarthBox. |

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| Title | Lesson 3: Data Log |
| Overview | The students will track the growth of the plants and make daily observations in the science notebook.  Duration: From the time seeds are put into EarthBox up until they tangle together and are longer than a meter stick |
| Standards | Reading/Writing:  ELA.4.W.C12.1: write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.  Math: M.4.MD.1: know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec, within a single system of measurement, express measurements in a larger unit in terms of a smaller unit, record measurement equivalents in a two column table, (For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in.) and generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36)  21st Century Skills: 21C.O.3-4.1.LS.3  Student articulates thoughts and ideas accurately and effectively through oral, written or multimedia communications.  21st Century Skills : 21C.O.3-4.3.LS.4  Student appreciates, accepts, and works cooperatively with others, in both academic and social contexts, shares responsibility for continued improvement of the academic performance and climate of the school, and exhibits ethical behavior while working alone or communicating with others.  21st Century Skills: 21C.O.3-4.3.LS.6  Student focuses on the larger goal of a project, frames appropriate questions related to the goal, develops and initiates a plant of action with specific tasks and appropriate benchmarks, and completes the project on time.  21st Century Skills: 21C.O.3-4.1.TT.5  Student uses word processing software to create and format a document, use Edit menu to cut, copy, paste and change font type, size and color, select and highlight text, and other common editing features.  21st Century Skills: 21C.O.3-4.1.TT.6  Student enters data into a spreadsheet, performs simple calculations, aligns data, applies different formats, and creates simple graphs and charts using the chart wizard.  21st Century Skills: 21C.O.3-4.1.TT.10  Student selects and uses appropriate software, other technologies, and grade level appropriate search engines to locate and acquire information from electronic resources. Student evaluates information found for content and usefulness.  21st Century Skills: 21C.O.3-4.2.TT.3  Student uses technology tools for individual and collaborative writing, communication, and publishes activities to create informative products for audiences inside and outside the classroom. |
| Materials/Advance Preparation Needed | Materials:   * Science notebook, * rulers, * computers, * Excel   Advanced Preparation: introduction to measurement and using a ruler |
| Procedures/Steps:  (Emphasis on students making inquiry, e.g., posing questions/problems and working towards answers and solutions) | Explain to students that they are going to collect data daily about their plants. Since they are growing the cucumbers in the classroom they will be able to observe them up close. Ask the students what type of data they think they should collect about the plants (some ideas: observation notes and height of the plant). Ask students how they would organize this data and where they should record what they observe. Help students prepare a place in their notebook for their notes. Review the format that their observations should be in. If the class decides to collect the height of the plants, help them set up an Excel document so they have a place to record the data.  Place students into small groups and assign them a specific plant to observe and collect data on. Having more than one student responsible for a plant ensures that you get daily data even if students are absent.  Make time every day for students to observe plants, collect data and record what they notice. After several weeks (when plants become too difficult to measure because they become tangled and longer than a meter stick) have the students create a graph of their plant growth. Have a discussion to compare plants and draw conclusions about the cucumber plants. Have students continue to make daily observations and record these in their science notebooks.  Students will use these observations to draw conclusions about direct seeding versus transplants. Their notes will also help them with their summer garden project. |
| Assessment (What will be the evidence of student learning?) | Students will be assessed by the data they collected in the science notebook as they decided as a whole class. The students will also be assessed by their Excel document and graph of the plant growth. |
| Title | Lesson 4: Trellis |
| Overview | The students will design and construct a trellis for the cucumbers.  Duration: 1 day |
| Standards | Science and Engineering Practices: Asking questions and defining problems; Developing and using models; Using mathematics and computational thinking; Constructing explanations and designing solutions.  21st Century Skills: 21C.O.3-4.1.LS.1  Student identifies information needed to solve a problem or complete an assignment, conducts a search and prioritizes various sources based on credibility and relevance, retrieves relevant information from a variety of media sources, and uses this information to create an effective presentation.  21st Century Skills: 21C.O.3-4.1.LS.3  Student articulates thoughts and ideas accurately and effectively through oral, written or multimedia communications.  21st Century Skills: 21C.O.3-4.2.LS.1  Student engages, with teacher assistance, in a critical thinking process that synthesizes knowledge and ideas.  21st Century Skills: 21C.O.3-4.2.LS.3  Student engages in a problem solving process that promotes questioning, planning investigations and finding answers and solutions.  21st Century Skills: 21C.O.3-4.2.LS.4  Student generates ideas for solutions to problems and asks questions in order to create unusual, unique or clever products. Student begins to cognitively recognize the skills of adapting, improving, modifying and expanding existing thoughts or ideas to create products.  21st Century Skills : 21C.O.3-4.3.LS.4  Student appreciates, accepts, and works cooperatively with others, in both academic and social contexts, shares responsibility for continued improvement of the academic performance and climate of the school, and exhibits ethical behavior while working alone or communicating with others.  21st Century Skills: 21C.O.3-4.3.LS.6  Student focuses on the larger goal of a project, frames appropriate questions related to the goal, develops and initiates a plant of action with specific tasks and appropriate benchmarks, and completes the project on time. |
| Materials/Advance Preparation Needed | Materials:   * strong string, * trellis starter kit (with EarthBox) or PVC pipe (three pieces and two elbow pieces to make a squared off arch), * computer * projector   Advanced Preparation: Prepare the frame for the trellis and collect strong string or wire for students to make the trellis. |
| Procedures/Steps:  (Emphasis on students making inquiry, e.g., posing questions/problems and working towards answers and solutions) | Once the cucumber plants have started to grow larger the students may notice that they are trying to grow out of the container. Explain to students that they will create a trellis to help the cucumber plants grow up instead of out. Look at some examples of trellis’s online. Then ask students what conclusions they can draw about a trellis? What is it used for? What things do they notice about all the trellises?  OR  Present students with the problem of the cucumbers growing outside of their container and ask them to research how to solve this problem. Allow the students to research possible solution and then come together for a class discussion. Allow the students to share what they have found in their research and then lead the discussion towards building a trellis.  Give students 10 minutes to work independently or with a partner and have them design a trellis for their plants. Then allow time for the students to explain their trellis design to the class. As a whole class select a trellis design that students can create with the supplies they have (frame and string). Then have small groups of student help create the trellis design. |
| Assessment (What will be the evidence of student learning?) | Students’ participation in a group discussion to help create a trellis design. The students will then use the trellis design and work together to create the trellis. |

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| Title | Lesson 5: Pickles |
| Overview | The students will use the cucumber crop to make pickles following a recipe of their choice.  Duration:2 days to prepare and a few days to pickle and a day to taste |
| Standards | Reading/Language Arts:  ELA.4.R.C3.3: interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the informational text in which it appears.  ELA.4.W.C9.1: Write opinion pieces on topics or texts supporting a point of view with reasons and information. |
| Materials/Advance Preparation Needed | Materials:   * Cucumbers, * pickling salt, * vinegar, * dill, * garlic, * sugar, * water, * jars, * plastic bowls, * knives, * measuring cups and spoons   Advanced Preparation: Read some material on making pickles and get parents involved to help out.  Resource: Pickle Basic information: [www.clemson.edu/extension/hgic/food/food\_safety/preservation/hgic3100.html](http://www.clemson.edu/extension/hgic/food/food_safety/preservation/hgic3100.html) |
| Procedures/Steps:  (Emphasis on students making inquiry, e.g., posing questions/problems and working towards answers and solutions) | Day 1:  Put students into 4 or 5 groups and have them search for a pickle recipe (you might want to find a few and allow students to pick from the options). The students will then provide the recipe and a list of supplies.  Example Recipes and information websites:  University of Wisconsin : <http://learningstore.uwex.edu/assets/pdf/b2267.pdf>  Colorado State University: [www.ext.colostate.edu/pubs/foodnut/09304.htm](http://www.ext.colostate.edu/pubs/foodnut/09304.htm)  Oregon State University: <http://extension.oregonstate.edu/fch/sites/default/flies/documents/pnw_355_picklingvegetables.pdf>  Day 2:  Once you have all the supplies the students need, students will be able to follow their recipe and create a pickle recipe. Students will work in groups to follow the directions on the recipe and prepare their cucumbers (this is a great opportunity to get some parent volunteers involved).  Day 3:  Then bring out the pickles and have a class taste test. Set up the four/five different types and label them A-E. The students will taste the different types and then write a review for their favorite one. This is a great opportunity to use descriptive words and vivid vocabulary to explain what makes one recipe better than the rest.  \*\* Possible extension: Students could create an advertisement for their pickles. |
| Assessment (What will be the evidence of student learning?) | Observation of students’ participation in their groups to create pickling solution. Students descriptive paragraphs supporting their favorite type of pickles. |