Saturday Science Quest for Kids Teaching- Spring 2019
Powering People and Powering Our Planet 3rd and 4th Grade
Teachers: Allissa Haney & Qui Zhong

Main Content

Lesson Plan Week 1-Powering People Through Food

A. Learning objectives and criteria for determining if objectives were met
    a. At the conclusion of this week's activities, each student would have the knowledge of the basic nutrients that necessary for different plants.
    b. At the conclusion of this week's activities, each student would know the main components of soil by doing the first part of the composting activity.
    c. At the conclusion of this week's activities, each student would know the characteristics of different seeds and how these characteristic related to plants' different reproduction strategies.

B. Standards https://www.nextgenscience.org/
    a. **3rd-5th grade:** 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
        i. Crosscutting concept: Cause and effect relationships
    b. **3rd-5th grade**: 3-LS4-2 Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing
        i. Crosscutting concept: Cause and effect relationships, and scientific observations.

C. Teacher content knowledge
- Seeds have many different characteristics and many plants employ different strategies for successful reproduction. For example, some seeds are large and drop very near the parent plant (this is the case for climbing plants) however others are very thin and can be blown away in the wind so they do not compete with the parental plant (these plants like lettuce also need less water to germinate).
- There are different soil types and each type of plant has preferred soil types. Because of this cabbage and strawberries cannot be planted next to each other because they need different types of soil to grow well.
- Soil is made from decomposing matter. Worms and other decomposers like fungi help break down organic matter into nutrient rich soil.
- Plants have different needs for nutrients. Some plants are incompatible when planted side by side because of their differences in essential nutrients. For instance, Carrots and potatoes compete with each other for phosphorous and strawberries and broccoli also compete for essential nutrients.
- Other plant knowledge includes making the students mindful of what they are planting in terms of how large the plants get. For example, tomato plants will grow large and shade out bean plants. Some other information to be mindful of is how each plant is harvested. Onions bulbs are pulled out of the ground and should not be planted near peas/beans because they contain shallow roots and can be uprooted while the onion is being harvested.

- Cultural diversity knowledge: different main foods for people from different parts in the world, and the characteristics of the foods.

D. Materials *safety concern materials

Scientific notebook construction

- color paper sheet 1/notebook
- lined paper sheet 7-10/notebook
- Stapler

Planting activities

- 4.5inch diameter plastic containers
- Potting soil
- Seeds (radish, beans, lettuce, purple cabbage)
- Plastic beakers
- Water

Composting activity

- Styrofoam container
- Newspaper
- Composting worms
- Fruit to feed the worms (Apples work great)

Garden Plan

- Cardboard (scale version of plot)
- Poster board cut to 3 sizes (1 row, 1/2 row, 1/3 row)

E. References

- http://compost.css.cornell.edu/worms/steps.html
- https://www.motherearthnews.com/diy/garden-yard/make-worm-bin-ze0z11zhir
- https://www.gardeningknowhow.com/edible/vegetables/vgen/incompatible-garden-plants.htm
- https://www.youtube.com/watch?v=uB61rfeeAsM
- https://www.youtube.com/watch?v=if29mjcd5bc

F. Tentative outline

9:30-9:40 Introduction of instructors and the theme of the course
9:40-10:10 Planting activity
10:10-10:30 Nutrients necessary for different plants
10:30-10:45 Break
10:45-11:15 Making soil
11:15-11:55 Start garden plan

G. Lesson description using 5E model

Time	Description	5 E component

9:30-9:40	**Introduction to us and the course** Go over powering people with food and power from the planet (clean energy)	**Engage** students in our topic as a whole.
9:40-10:10	**Planting activity** Students will plant different seeds at the edge of the containers to watch them grow in 5 weeks • each week, they will make observations on the changes of the plants and record them in their laboratory notebook. As the students are planting the teachers ask the students some thought questions: • How long do you hypothesize it will take to grow? • Will the plants look different? • Will your bean grow the same as another students bean?	**Engage and explore.** Students will explore the characteristics of plants growing through the 5 weeks. Students will write and **explain** their hypotheses.
10:15-10:30	**Nutrients necessary for different plants** 15 min. Explaining what is in the soil and a video or slides. Nutrient cycling https://www.youtube.com/watch?v=if29mjcd5bc https://www.youtube.com/watch?v=uB61rfeeAsM	**Engage, explain.** Students will discuss nutrients necessary for their plants
10:30-10:45	**Break time** Students had given previous feedback that they liked to watch videos at the end of this break time so we continued the clean energy conversation with a few videos/ short discussions.	Students **explained** and **elaborated** about clean energy types they had seen and how they worked. They also asked many great questions.
10:45-11:15	**Making Soil** 1. 15 min. All kids will help to make one composting container using the remaining potting soil, Styrofoam insulated container, newspaper, apples, and earthworms.	**Engage, explore** Students have a chance to make the soil by themselves to explore how soil forms and what makes soil

	2. On board (Gather around, Students help put soil in, put worms in, put chopped apples in, Cover with wet newspaper) 3. 5-10 minutes discussion Starting with them answering 3 questions in their notebooks. (1) What will happen in the container? (2) What is soil? (3) What do worms have to do with it?	
11:15-11:55	**Start Garden Plan** 30min. (what foods do you eat most of-poll?) Help students break down their favorite food to components	**Engage and explore**

Powering People and Powering Our Planet 3rd and 4th Grade

Lesson Plan Week 2-Powering People Through Food

A. Learning objectives and criteria for determining if objectives were met
   a. At the conclusion of this week's activity, each student would be able to see the changes of their plants and see the different characteristics of the seeds while growing.
   b. At the conclusion of this week's activity, each student would know the categories of macronutrients for humans, and be able to identify them from the labels or packages of foods.
   c. At the conclusion of this week's activity, each student would know what the role of worms plays in making soil, and know the characteristics of the habits for worms.

B. Standards https://www.nextgenscience.org/
   a. **3rd-5th grade:** 5-PS3-1 Use models to describe that energy in an animals' food (used for body repair, growth, motion and to maintain body warmth) was once energy from the sun.
      i. Crosscutting concept: Energy and matter
   b. **3rd-5th grade**: 5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
      i. Crosscutting concept: Systems and system models

C. Teacher content knowledge
   - The basics for growing plants are having nutrient rich soil, a sunlight source, adequate water, and planting the seed at the depth necessary for that specific seed type.
   - Composting happens when organic matter has been sufficiently degraded by a decomposer into what we call soil.
   - The main nutrients humans get from food

D. Materials *safety concern materials
   Nutrient activity
   - lara bars
   - goldfish in package
   - crackers and cheese

   Main food demonstration
   - rice
   - flour
   - corn
   - beans

- potato

Seed art activity

- Cardboard frames 1/student
- Elmers glue
- Variety of seeds (shape, size, and color variations)

E. References

- https://www.amazon.com/Paper-Photo-Picture-Frames-Cardboard/dp/B07DCRH2GK/ref=sr_1_9?keywords=cardboard+picture+frames&qid=1553277235&s=gateway&sr=8-9
- https://www.youtube.com/watch?v=L9ymkJK2QCU
- https://www.youtube.com/watch?v=z9TIlM96lT8
- https://www.youtube.com/watch?v=w77zPAtVTuI
- https://www.youtube.com/watch?v=sMK-BKUYM0s

F. Tentative outline

9:30-10:30 Garden plan continued
10:30-10:45 Break
10:45-11:15 Humans and foods
11:15-12:00 Seeds art
Flexible time: Observe the plants and worms

G. Lesson description using 5E model

Time	Description	5 E component
9:30-10:30	**Garden plan continued** Finish planning garden outline: Observe plants from last week (Videos for beans growing, lettuce growing) Based on a poll given to the students a week before we came up with a planting list: [Tomatoes, Onion, Watermelon, Garlic, Potatoes, Spinach/lettuce, Carrots, Cucumbers, Wheat, Corn, Pizza Herbs, Cabbage, Strawberries, Broccoli, Grapes, Beans, Peas Cantaloupe] Students made their own garden plan by laying tiles inside their cardboard garden plot. As the students were deciding what to plant the teachers and volunteers were circulating talking with students about;	**Explore:** observe the plants, draw them on the note book and compare them with last week's plants drawing to see the changes and make **explanations** **Engage** the students in talking about food, and **explore** what other people from a different culture background eat

	• Different types of seeds • Different types of plants • Types of plants that give multiple vegetables/fruit (cucumbers, tomatoes, strawberries) • Types of plants that only give 1 fruit/vegetable (onions, carrots) I**ncompatible plants** •Tomato and beans (tomatoes too big and shade the beans) •Onions and Peas/Beans (Uprooting peas when you take out onions) •Cabbage and strawberries (different soil types) •Carrots and potatoes (both compete for phosphorous) Students needed to check their garden plans to be sure no incompatible plants were designed next to each other. Garden plan layout checked by teacher before snack	Students were asked to **evaluate** their final garden plans by making sure they did not have any incompatible plants next to each other. They then **explained** their garden plans to the students around them. Finally, students were asked to **Explain** their plans to a teacher or volunteer as an **evaluation** of their final design.
10:30-10:45	**Break time.** Students had given previous feedback that they liked to watch videos at the end of this break time so we continued the clean energy conversation with a few videos/ short discussions.	Students **explained** and **elaborated** about clean energy types they had seen and how they worked. They also asked many great questions.
10:45-11:15	**Humans and food** (1) Macronutrients necessary for people (Carbohydrates, Protein, Sugar, Fiber) activity to search ingredient lists for the components in food (2) Humans around the world eat different types of food- main food groups around the world (3) Learning more about seeds	**Engage, explore,** and **explain:** **Engage** the students to talk about the main categories of nutrients that needed for human being and help them to **explore** the main functions of different nutrients for human body. Students are also expected to **explain** different diet plans for different purposes.

11:15-12:00	**Seed art** (Exploration of color, shape, and size) Why seeds are different? (1) Introduce some different kinds of seeds (shape, size, colors) (2) Tell them what need to do for art seeds: decorate the frame and use seeds to represent the vegetables in the garden plan.	**Explore** the characteristics of different seeds including the shapes, colors, sizes and textures. **Engage** the students to think about the reason why different seeds have different characteristics.
Flex time	**Observe the composting bin**	**Explore, explain, and evaluation.** Students will see and **explore** how the soil forms step by step and **explain** what makes good soil. In the meantime, they will **evaluate** whether the soil they made is good for the worms inside to live and think about how to improve next time or in practice.

Powering People and Powering Our Planet 3rd and 4th Grade
Lesson Plan Week 3-Solar Energy

A. Learning objectives and criteria for determining if objectives were met
   a. At the conclusion of this week's activity, the students would know the concepts of solar energy and the application of solar energy in daily life, and the simple principles for the application.
   b. At the conclusion of this week's activity, the students would be able to use solar energy to light up LEDs and using solar energy to heat up the water, and be able to make explanations for the phenomenon.
   c. At the conclusion of this week's activity, the students would know the concepts of greenhouse and know how it forms and the main functions of greenhouse. Students would have a personal experience of what greenhouse is, what it looks like, and what kinds of plants can be found in a greenhouse by visiting a greenhouse located in IU campus.

B. Standards https://www.nextgenscience.org/
   a. **3rd-5th grade**: 4- ESS3-1Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
      i. Crosscutting concept: Cause and effect, interdependence of science, engineering, and mathematics, and the influence of STEM on the natural world.
   b. **3rd-5th grade:** 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
      i. Crosscutting concept: Energy and matter, connections to engineering and math, influence of STEM on the natural world, the influence of people on science and technology.

C. Teacher content knowledge
   - The concepts of solar energy; The solar panels are able to capture the energy given off from the light and the panel converts this solar energy to electrical energy that can then be used to power something that is hooked to the solar panel. When solar panels are hooked together they generate more energy than one singular solar panel.
   - Greenhouses are an example of passive solar. Passive solar is a term used to describe when the sun can heat something, in this case a building. In a greenhouse the sun also provides all the wavelengths of light needed for the plants to grow. The glass of the greenhouse allows light to come, but it traps the heat in the greenhouse allowing the plants to survive longer indoor when the weather gets cold.

D. Materials *safety concern materials

Passive greenhouse activity if there is no greenhouse to show the students

- 1 or 2 cardboard to construct a small “building”
- 4-6 of black film containers
- 2 heating lamps*

Solar panel activity:

- Solar panels
- Heating lamps*
- LEDs
- Electric motors
- Volt meters

E. References

a. https://www.youtube.com/watch?v=JtTDx8_dlsE

- https://www.amazon.com/Sunnytech-100ma-Module-Polysilicon-Charger/dp/B008J9BZIA/ref=asc_df_B008J9BZIA/?tag=hyprod-20&linkCode=df0&hvadid=167157220945&hvpos=1o1&hvnetw=g&hvrand=15811985333688836405&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-375588486157&psc=1
- https://www.amazon.com/Diffused-10mm-mixed-color-pack/dp/B07KWFSLZG/ref=asc_df_B07KWFSLZG/?tag=hyprod-20&linkCode=df0&hvadid=309806250188&hvpos=1o3&hvnetw=g&hvrand=15948027116840935146&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-663015140319&psc=1
- https://www.amazon.com/10000RPM-Mini-Magnetic-Motor-Smart/dp/B008595SC8/ref=asc_df_B008595SC8/?tag=hyprod-20&linkCode=df0&hvadid=167140365824&hvpos=1o1&hvnetw=g&hvrand=4571053058388697973&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-500535824112&psc=1

F. Tentative outline

9:30-9:45 Check plants and draw them
9:45-10:00 Passive solar
10:00-11:00 Green house activity: what is a greenhouse (greenhouse visit)
11:00-11:15 Break
11:15-12:00 Solar energy activity

G. Lesson description using 5E model

Time	Description	5 E component
9:30-9:45	**Observation of the student’s plants that have been growing since week 1**. Students are asked to draw their plants and roots and also explain in words and measurements what they see. We keep this consistent each week so students know what to expect as soon as they enter the classroom.	**Engaging** activity that we start with each week. Students also learn the importance of scientific observations and notetaking.

9:45-10:00	**Passive solar (What does solar mean?) Watch Solar video** Before the video: How can solar energy be used? How you feel when you stand in the sun? Why it is hot during the day and cold at night?	**Engage and explain** (the concept of solar energy and the application of the solar energy in daily life)
10:00-11:00	**Green house activity what is a greenhouse?** Initiate discussions about greenhouse: • Have you ever been to a greenhouse? • Do you know anything about green house? • Do you know any vegetables that grow in the greenhouse? • Why people grow vegetables in greenhouse? Go visit a Greenhouse or do the passive greenhouse activity to show students how a greenhouse warms up.	**Engage, explore, explain, elaboration and evaluation.** During the visit, students will think about what a greenhouse is, how it works. By listening to their answers, teachers would be able to **evaluate** whether they understand.
11:15-12:00	**Solar energy activity** Introduce by activating students, previous knowledge; • What do you need power for? • How can you get this power from the sun? Try to produce energy to light your LED and heat your water (in two separate working stations) Having specific prompts helped students stay on task. Prompt 1 How much power do you use? How many lights are in your house? Prompt 2 Find 2 different ways to power your LED (Students figured out 1 was the lamps provided and the second was the sun coming in the window)	Students **explore** how solar can be used in many different ways. They also practice their techniques-based communication skills. Many students were very **engaged** in the hands-on activity and were able to **explain** their work to other students and to the teachers/volunteers as they circulated through the room asking questions. They were **evaluated** during these questions and redirected if necessary.

Powering People and Powering Our Planet 3rd and 4th Grade
Lesson Plan Week 4-Wind Energy

A. Learning objectives and criteria for determining if objectives were met
    a. At the conclusion of this week's activities, each young scholar will be able to identify and describe the pros and cons of multiple types of renewable energy sources.
    b. At the conclusion of this week's activities, each student will be able to design and develop a unique functional windmill through trial and error as well as collaboration with other students.
    c. At the conclusion of this week's activities, our young scientists will be able to compare and contrast the use of wind and solar energy to power similar objects.
B. Standards https://www.nextgenscience.org/
    a. **3rd – 5th Grade:** 3-5-ETS-1 Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.
        i. Crosscutting concepts included; Scientific troubleshooting involves many iterations, critical thinking about size and weight of materials while building, and the influence of science, engineering, and technology on society and the natural world.
    b. **3rd - 5th Grade:** 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of a problem.
        i. Crosscutting concepts included; Some problems may need multiple solutions, the use of appropriate tools strategically, and the influence of science, engineering, and technology on society and the natural world.
    c. **4th Grade:** 4-PS3-4 Apply scientific ideas to design, test, and refine a devise that converts energy from one form to another.
        i. Crosscutting concepts included; Energy transfer between objects, people/teams improve or develop technologies, and science effects everyday life.

C. Teacher content knowledge:

Content Knowledge:

- There are many clean/renewable/green energy sources available on Earth. Specific for this lesson wind energy will always be around no matter how many wind turbines are constructed.
- Anyone who is hooked to the grid can sell back extra energy to the electric company and get paid for it!
- Energy can be stored in batteries for use later or on non-windy days.

Activity Knowledge:

- By running a motor in the reverse direction, you can create power whereas running it in the forward direction uses power. This activity uses a hobby motor that is 6-12V because the motor has to be powerful enough to run the LED and easily available hobby 3V motors are not powerful enough to light LEDs.

- Before the activity glue 2 popsicle sticks of the same size at 90 degree angles (enough for each student to have at least 1 set of large and 1 set of small “turbines”) Drill a hole through the center of the turbines and be sure this fits onto the motor.
- Depending on how students construct their windmill turbines they may spin the motor in the opposite direction the easy fix is to switch the LED terminals (long stem on black for some motors and then long stem on red for others) on some of the motors.
- Teacher must keep in mind size of fin to capture wind and weight of the turbines.

D. Materials *safety concern materials

Wind Turbine Activity Prep (Teacher prep ahead of time)

- Drill with 1/16 drill bit (teacher only)
- Small popsicle sticks
- Large popsicle sticks
- Elmers strong glue
- 6-12V motors
- LED lights

Wind Turbine Activity (enough for students to choose their own materials)

- Scissors
- Elmers glue
- Thick cardboard cut in multiple sizes
- Thin cardboard (paper towel rolls) cut into multiple sizes
- Foam Board
- Cardstock
- Construction paper
- Streamers
- Voltage meter

E. References

https://www.youtube.com/watch?v=HciKU63dLtA
https://www.youtube.com/watch?v=av24fEMhDoU
https://www.youtube.com/watch?v=1sI_ot8qoXEwind
https://www.exploratorium.edu/snacks/light-wind

F. Tentative outline

9:30-9:45 Observations of plants and roots from week 1
9:45-10:25 Finish Solar Activity
10:25-10:40 Break
10:40-10:50 Wind Power Introduction
10:50-12:00 Wind Power Activity

G. Lesson description using 5E model

Time	Description	5 E component

9:30-9:45	**Observation of the student's plants that have been growing since week 1**. Students are asked to draw their plants and roots and also explain in words and measurements what they see. We keep this consistent each week so students know what to expect as soon as they enter the classroom.	**Engaging** activity that we start with each week. Students also learn the importance of scientific observations and notetaking.
9:45-10:25	**Wrap up of previous weeks' solar activity.** Here we placed all of the tools (Solar panels, light to power the panels, batteries, electric motors, LEDs, and voltmeter) Allow students to lead the discussion on how the system works for any students absent the previous week. Then allow students to answer the questions on the worksheet however they would like. Teachers and volunteers circulate while the student driven inquiry is happening and ask students to explain their solar powered devices. • How does this work? • Can you prove this is the way it works? Wrap up with a conversation about solar power • What can we run off of solar? • What type of devices in your everyday life could be run off solar? • How can we store solar energy?	Students **explore** how solar can be used in many different ways. They also practice their techniques based communication skills. Many students were very **engaged** in the hands-on activity and were able to **explain** their work to other students and to the teachers/volunteers as they circulated through the room asking questions. They were **evaluated** during these questions and redirected if necessary. The students were able to **elaborate** on their experience through the discussion.
10:25-10:40	**Break time.** Students had given previous feedback that they liked to watch videos at the end of this break time so we continued the clean energy conversation with a few videos/ short discussions.	Students **explained** and **elaborated** about clean energy types they had seen and how they worked. They also asked many great questions.
10:40-10:50	**Introduction of wind power** through a clean energy video and discussion. After watching the short video we prompted the students for any previous knowledge with questions like: • Have you ever seen a wind turbine before?	Students **explored** how wind energy could be used through discussions after watching a short video about clean energy.

	• How do they work? • How do they power other things? • Do you think you could make a turbine?	They were able to **explain** their previous knowledge and current hypothesis to the class in these discussions as well.
10:50-12:00	**Wind Power Activity**. This activity is student driven. The students choose their own materials and assemble them in a way they think will work as a windmill. Then they test their designs and with some guidance during testing they will rework their designs to produce functional windmills that can power LEDs. Teachers and volunteers evaluate and help lead students during construction and testing of the turbines. Some sample questions for building are: • Why did you choose this material? • What modifications have you made to make it spin? • What do turbines look like that you have seen? Some sample questions for testing are: • What will happen if it is too heavy? • What will happen if it cannot catch enough air from the fan? • What if the wind is trying to spin it both ways?	This activity was designed to be a <u>student led, inquiry-based design</u> activity. Students had to activate their previous knowledge to make and **explore** the workings of a windmill. Then **explain** to their peers how their windmill worked. **Evaluation** occurs during building and testing of their model turbines.

Powering People and Powering Our Planet 3rd and 4th Grade
Lesson Plan Week 5- Our Carbon Footprint

A. Learning objectives and criteria for determining if objectives were met
    a. At the conclusion of this week's activities, our young scientists will be able to explain the concept of carbon footprint and explain about their own carbon footprint.
    b. At the conclusion of this week's activities, each student will be able to analyze what exactly is needed to live and what items in their everyday life are luxuries.
    c. At the conclusion of this week's activities, each young scholar will be able to plan and construct a layout/blueprint of an ECO house.
B. Standards https://www.nextgenscience.org/
    a. **3rd-5th grade:** 3-5ETS1-1 Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.
        i. Crosscutting concepts; Influence of STEM fields on the natural world, the students realizing they will get to make their own decisions someday.
    b. **3rd -5th grade:** 5-ESS3-1 Obtain and combine information about ways individual communities use science to protect the Earth's resources and environment.
        i. Crosscutting concepts; Systems and System models, science addresses questions about the natural and material world, influence of STEM on the natural world.
    c. **3rd-5th grade:** 3-5ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.
        i. Crosscutting concepts; Cause and effect of daily practices, influence of STEM fields on the natural world, engineering is accessible to everyone.
C. Teacher content knowledge

    Content Knowledge

    - Carbon footprint is a term used to estimate the amount of the greenhouse gas, carbon dioxide (and to a smaller extent other carbon compounds) emitted into the atmosphere by the burning of fossil fuels. This footprint can be attributed to a person or group of individuals.
    - Every item that is made has the potential to have a carbon footprint. From the molding of the item-to the packaging-to the transportation to get you that item.
    - An ECO house is a tiny house (contains all necessities), which has a far smaller carbon footprint for the build, maintenance, heating and cooling, etc. These are also easier/cheaper to power with solar and wind. Needing roughly 4 solar panels (2019 approx. $7K) or 1 windmill (2019 approx. $9K) based on house energy averages in 2019.

    Activity Knowledge

- 5D planner is a free software that will allow you to make certain square footage house plans.
- The only instructions are to get the students started and kept on task.
  1. Google “Planner 5D”
  2. Choose “get started for free”
  3. Select “start from scratch”
  4. Select a shape and drag it onto the screen
  5. On the right toolbar go to settings to change the units to ft^2
  6. Drag the shape to be 400 ft^2 then make new rooms inside this footprint.
  7. Mandatory rooms that students came up with (Bedroom, Bathroom, Kitchen) These were necessary, and I constrained the number of rooms to a max of 6. This keeps them on task and not making 100 tiny rooms.

D. Materials *safety concern materials
- Access to computer lab and internet for each student.
- Tiny house books for inspiration

E. References

- https://www.youtube.com/watch?v=1sI_ot8qoXEwind
- https://www.youtube.com/watch?v=8q7_aV8eLUE
- https://www.youtube.com/watch?v=Dwkh46MZuIc
- https://planner5d.com
- Mitchell, R. (2014). *Tiny house living: Ideas for building and living well in less than 400 square feet*. Cincinnati, OH: Betterway Home.
- Mitchell, R. (2016). *Tiny houses built with recycled materials: Inspiration for constructing tiny homes using salvaged and reclaimed supplies*. Avon, MA: Adams Media.
- Mok, K. (2018). *The modern house bus: Mobile tiny house inspirations*. New York, NY: The Countryman Press, a division of W.W. Norton & Company.

F. Tentative outline

9:30-9:45 Observations of plants and roots from week 1
9:45-9:55 Sustainability Discussion (Students previous knowledge)
9:55-10:00 Clean Energy Video
10:00-10:15 Break
10:15-10:30 Carbon Footprint discussion
10:30-12:00 Design and build an ECO house

G. Lesson description using 5E model

Time	Description	5 E component
9:30-9:45	**Observation of plants and roots from week 1**. Students are asked to draw their plants and roots and also explain in words and measurements what they see. We keep this consistent each week so students know what to expect as soon as they enter the classroom.	**Engaging** activity that we start with each week. Students also learn the importance of scientific observations and notetaking.

9:45-9:55	**Sustainability Discussion**. This discussion started with only one word on the board "Sustainability" then the question was asked to the class, what does this word mean? This was a great way to hear different voices in the class and to hear what it means to them. We ended up with many words on the board that we were able to pull together into their very own definition of sustainability. This was a great jumping off point into discussions around clean energy and our carbon footprint.	Students were **engaged**, **explored** and **explained** what sustainability meant to them and their peers through helping make our own definition of the word. The words given were **evaluated** for relevance only.
9:55-10:00	**Clean energy video** We started this video after 1:25, where we had stopped it previously, to facilitate the students thinking about all the different ways clean energy can be used. This also pulled together the use of solar and wind.	Students were able to **elaborate** on how they could use clean energy in many areas of their life.
10:00-10:15	**Break** Students had given previous feedback that they liked to watch videos at the end of this break time so we started the carbon footprint conversation with a few videos/ short discussions. The videos are always used to start student discussions.	Students were **engaged** by the videos to learn more about their carbon footprint.
10:15-10:30	**Carbon footprint discussion** the video titled what are carbon footprints had a great breakdown of the areas of your life that you can cut back your carbon footprint. The video was paused here and we had the students brainstorm ways to lower their carbon footprint from each category. The biggest way to reduce from many categories is to live in a smaller house (less carbon for building materials, less heat, less to cool, less to maintain a smaller structure) After the main discussion about what could be done in their everyday lives, we jumped into what can you do differently once you have your own house and vehicles etc? Another useful discussion tool was to have the students think about what you really need to survive?	Students had to **explain** and help the class brainstorm to reduce their carbon footprint for each area of their lives. Students had to break away from traditional thinking to come up with building a smaller house, but they were able to get there once they started **exploring** with "crazy ideas". Again, each idea was **evaluated** only on relevance and not on if it is currently able to be done.
10:30-12:00	**Design and build an ECO house** Students were given a guide that told them the	

	parameters they needed to work in and easy tips for using the free online Planner 5D software. Once setup the students were free to engineer their very own ECO house (also called a tiny house). Once each student had made their blueprints we talked about the amount of solar or wind power needed to power their homes. Final discussions about sustainability were had to pull together all 5 weeks of the program.	

Appendix 1

Hot water heater worksheet

Draw this in your notebook:

How do you use hot water at home? Can you come up with 5 ways?				
Temp 1:	Temp 2:	Temp 3:	Temp 4:	Temp 5:
What if more light was added?				

*While waiting, ask a teacher about hot water option.

Before leaving this station, a teacher has to sign this page in your notebook!

Appendix 2

Using Solar for Light worksheet

Draw this in your notebook:

How many lights do you use at home?
Can you find 2 ways to light your LED light? Draw them. <u>Way 1</u> <u>Way 2</u>
Can you make the light brighter? How did you do this?

Before leaving this station, a teacher has to sign this page in your notebook!

Appendix 3

What else can we power by solar worksheet

Draw this in your notebook:

What else needs power in your house? What do you need every day that has to be powered?
How can we power these things with solar?
What else did you power with solar at this station?

Before leaving this station, a teacher has to sign this page in your notebook!

Appendix 4

What can we power with the wind?

Large Turbine Step #1 Light the LED (Draw it below) Step #2 How much power did you produce?		
Voltage 1	Voltage 2	Voltage 3
Small Turbine Step #1 Light the LED (Draw it below) Step #2 How much power did you produce?		
Voltage 1	Voltage 2	Voltage 3

Give two ways your turbines are different once you made them and they worked (large vs small)?

Appendix 5

Designing your very own ECO house! worksheet

It must be **400 ft²** (122 m^2) and contain **3-6 rooms**

Mandatory rooms:

Bathroom, Bedroom, Kitchen

Optional rooms:

living room, office/gameroom, dining room, storage room, walk-in closet.

Tips for using planner 5D:

Click a shape it will appear on screen.

Click inside the shape and you can change the type of room it is

Click and drag the edges to make the room smaller

If you accidentally click something wrong go back to your project and you design will come back

To save your project zoom in on the house design and click print screen- Then open Word and past in your picture

If you prefer you can hand draw your ECO house

Appendix 6

Summary of Our Courses and Supplement Information for Parents

Weeks 1-2 We designed a garden plan and had fruitful discussions around how to power people. If you are able please transplant your young scientist's plants to larger containers. If you are interested in planting some version of your child's garden plan and don't have space, here is some information regarding Bloomington's community garden plots:

Bloomington has 2 community garden areas one on the Northwest side of town and the other on the South side of town;

Butler community garden (A few blocks from Fairview Elementary school) 812 W. 9th St.

Small garden plot is 33-38 dollars for ~100 ft^2 garden (~10ft by 10ft)

Willie Streeter community gardens (Across the street from the YMCA-SE) 2120 S Highland Ave

Small garden plot is 37-44 dollars for ~100 ft^2 garden (~10ft by 10ft)

For more information, go to https://bloomington.in.gov/parks/community-gardening or call 812.349.3700

Weeks 3-4 We designed and engineered ways to heat water, light LEDs and charge batteries all with the power from the planet! If you would like more information on the solar panels and motors used to bring the science home, see below:

Solar panels and LED lights used in class!

Sunnytech 0.5w 5v 100ma Mini Small Solar Panel Module **(Amazon 1pk 6.99$)**

Diffused 10mm LED mixed color pack (**Amazon 20pk 9.49$**)

Wind turbine motor used in class (with the same LEDs as above)

DC 12V 10000RPM Mini Magnetic Motor for Smart Cars DIY Toys **(Amazon 1pk 4.53$)**

Week 5 We designed our very own ECO houses! If your child would like to continue the building process at home, we used the free online software called **Planner 5D.** We built a 400 ft^2 home and learned how to power it!

For a 400 ft^2 house we would need:

4 (345 Watt) solar panels

1 (1.5 kW) wind turbine

By building ECO (smaller) we would reduce our carbon footprint from **28,000 lbs of CO_2** per year to only **2000 lbs** per year!! *renewableenergyworld.com

Thank you all for supporting Saturday Science we had a blast with your **young Scientists!!**