

# 3D Teaching / STEM Project Unit Plan

## Design and Build Sailboats

by Little Bird Designs

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**Both NGSS and GSE (Georgia) science standards are given along with standards from other subjects that are addressed during this project.**

Georgia standards are listed first (for all subjects) and the NGSS are listed after them.

Georgia Standards of Excellence are copyrighted by the Georgia Department of Education. A complete copy of the GSE for kindergarten science can be found here:

<https://www.georgiastandards.org/Georgia-Standards/Documents/Science-Kindergarten-Georgia-Standards.pdf>

- **SKP1** Obtain, evaluate, and communicate information to describe objects in terms of the materials they are made of and their physical properties.
  - a. ask questions to compare and sort materials of different composition. (Common materials include clay, cloth, plastic, wood, paper, and metal.)
  - b. Use senses and science tools to classify common materials, such as buttons or swatches of cloth, according to their physical attributes (color, size, shape, weight, and texture).
  - c. Plan and carry out an investigation to predict and observe whether objects, based on their physical characteristics, will sink or float.
- **SKP2** Obtain, evaluate, and communicate information to compare and describe different types of motion.
  - a. Plan and carry out an investigation to determine the relationship between an object's physical attributes and its resulting motion (straight, circular, back and forth, fast and slow, and motionless) when a force is applied. (Examples could include toss, drop, push, and pull.)
  - b. Construct an argument as to the best way to move an object based on its physical attributes.
- **SSKH3** Correctly use words and phrases related to chronology and time. (Note: These elements should be integrated into discussions about historical events and figures.)
  - a. now, long ago
  - b. before, after
  - c. today, tomorrow, yesterday
  - d. first, last, next
  - e. day, week, month, year
  - f. past, present, future
- **SSKG2** Explain that a map is a drawing of a place and a globe is a model of Earth.
  - a. differentiate land and water features on simple maps and globes
- **ELAGSEK RF3** Know and apply grade-level phonics and word analysis skills in decoding words.
  - b. Demonstrate basic knowledge of long and short sounds for the five major vowels.
- **ELAGSEK W6** With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
- **ELAGSEK L2** Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
  - A. Capitalize the first word in a

sentence and the pronoun I. c. Write a letter or letters for most consonant and short vowel sounds (phonemes).

- **ELAGSEK RI 2** With prompting and support identify the main topic and retell key details of a text.
- **ELAGSEK RF 2** Demonstrate understanding of spoken words, syllables, and sounds. C. blend and segment onsets and rimes of single-syllable spoken words.

**K.CC.6** Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. (Include groups with up to ten objects.)

### **NGSS**

K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem

### **Suggested Sailboat Project Supply List:**

**\*Choose some items that you know will not fit in the container that will be used to test for the ability to float - choose a few items that will look appealing to students but will turn out not to work well if chosen. This helps broaden their opportunity for self-discovery by allowing them to experience the realization of why these items are not the best choice.**

- Various sizes of craft/popsicle sticks
- Bamboo cooking skewers
- Various types and weights of paper
- Playdough
- String/yarn
- Squares of aluminum foil
- Small (dessert size) paper plates
- Regular size paper plates
- Empty plastic fruit cup containers
- Approximately 1 inch thick slices off a rectangle of floral Styrofoam
- Glue - liquid and stick
- Small squares of thin cloth

### **Teacher Notes:**

Place an assortment of items on a table so that students can go "shopping" for supplies to begin the build of their sailboat. Give each student a paper lunch sack or other container they can use for a shopping bag. Let them know there is a limit on some supplies, i.e. one bamboo skewer, one piece of cloth, etc. After the first day explain they may go shopping again if their boat does not float and they need to change their design. Some items chosen for the base of the boat will turn out to be too large to fit in the container used to test for the ability to float. Let them discover the item is larger than the container and that they need something smaller.

Some items, like playdough, will look appealing as a means of standing the mast up in the center of the boat. Students may discover weight distribution when they see more playdough on one side than on the other side will cause their boat to tip over. Students will discover using glue alone is not enough to stand up the mast in the center of the boat - some will poke a hole in a paper plate and put a bamboo skewer through the hole for the mast. They will discover water comes in through the hole. Others will use the bamboo skewer for a mast on a small base like a fruit cup or section of Styrofoam and they will also discover weight distribution as the top heavy boat turns over. Allow them to discover the cause of their problems for themselves. They have all week to work with it and given time will discover amazing things that they will never forget. Do not guide them in which supplies to choose and do not tell them why things don't work. When a child is truly stuck ask them questions that help them find their own answers. This is about giving them what they need to have an experience through which they may discover wonderful things about science and the world around them. Be patient, allow them to find their own answers. You should be the bumpers on their bowling alley - not the hand that throws their strike.

Make sure students know at least a day in advance when the project is about to end so they can make final adjustments to their boat. On the final day set aside some time and allow each student to "sail" their boat. Video their sail and their discussion afterwards that explains their process and discoveries. Put the video in a google photo album for each child and share the album with their parents. Google photos is free and can be on your phone as an app that stores your photos saving room on your phone - and can be on your laptop or tablet which all sync making it easy for you to access your photos from any of your devices at any time. Once you make an album for each child at the beginning of the year - whenever you make a picture or video of that child you just put it in their album and parents have the gift of a digital "record" of their child's kindergarten experience. Parents LOVE that and will appreciate your efforts.

### **Making a Sailboat Raceway**

You can use a large container of just about any type with enough water to allow boats to float. Set the container on the floor so students can easily access it and watch each other. You can also take about 6 feet of PVC pipe and cut it in half - making sure to leave a few inches at each end uncut so that you can put pipe caps on the ends to make it water tight. You can roll a towel to stick against each side to keep it from tipping to the side or you can cut a wedge from plywood, or make a wood "cradle" from plywood if you are truly handy. I had my husband make mine because I am definitely not handy with such things. I am putting a photo you may use as an example. However, the first year I did this project I used a large, shallow, plastic container and it worked just fine. The pipe raceway was definitely better and well worth the time and effort - but you can do this project with any container you can come up with.



### **Phenomenon**

- Some things sink in water while some things float.

### **Science and Engineering Practices**

- Ask questions (science) and define problems (engineering).
- Develop and use models
- Use mathematics
- Constructing explanations (science) and designing solutions (engineering)
- Engage in argument from evidence
- Obtain, evaluate, and communicate information

### **Cross Cutting Concepts**

- Cause and effect: mechanism and explanation
- Scale, proportion, and quantity
- Structure and Function

### **Disciplinary Core Idea**

- PS2: Motion and Stability: Forces and Interactions
- ETS1: Engineering Design

### **Big Ideas Beyond Science**

- Maps show a certain area while globes show the entire earth.
- The blue areas on maps/globes show us where large bodies of water can be found. Other colored areas show us land. We can cross the land on our feet or in vehicles that move across the ground. One way to cross the water is to have a boat that floats. Another is to have a plane that flies (next week will be a focus on designing and building paper airplanes).

## ENGAGE

Possible Read Alouds:

1. Virtual Tour of the Mayflower  
[http://www.scholastic.com/scholastic\\_thanksgiving/voyage/](http://www.scholastic.com/scholastic_thanksgiving/voyage/)  
 (Purpose: ship/sail example, long ago and now, maps, vocab: mast, sail, retell key details)
2. How I Became a Pirate (Purpose: example of a sailing ship and smaller boat, maps, retell key details, author vs. illustrator, thinking beyond the text, fiction vs. nonfiction)
3. Scholastic Atlas of the United States (Purpose: informational text example, fiction vs. nonfiction, map examples)
4. Sailing off to Sleep (Purpose: boat example, sink vs. float, rhyming words, fiction vs. nonfiction, thinking beyond the text)
5. The United States of America, a State by State Guide (Purpose: maps vs. globes, features of maps, fiction vs. nonfiction)

## EXPLORE

- Design, build, test, adjust, and sail boats.
- Add a maps and globes collection to centers for students to examine and compare.
- Add a topic basket to centers with books that tell about or show boats and ships.
- Add a topic basket to centers with various types of maps, and books that include maps.
- Add examples of simple maps to the art center for students to try to duplicate.
- Add simple drawings of sail boats to the art center for students to look at and draw.

## EXPLAIN

- Keep a journal to document each stage of the project (add to existing Discovery Journal). Draw pictures of the items they choose for building their boat - write about it/make a list of items if possible.
- Have students create maps in the art center - show the water as blue on their map.
- In the writing center, write about where you would go if you had a sailing ship. Who would you take with you? What would you do when you got there?
- Class discussion: If you were planning a trip where would you go? How would a map help you on your trip? Would a sailing boat help you get there? (look up the location of student dream trips on google maps to show them on your smart board or promethean).

## ELABORATE

- Class will discuss/share observations of maps and globes at the end of centers each day.
- Students will test sailboat designs in water and consider any improvements that need to be made. Students will make improvements to their designs if needed. Students will share/discuss their thinking with their center group during centers and with the whole class at the end of center work time each day.
- Students will write about their progress/experience in designing/building their sailboat each day in their Discovery Journal.

- The teacher will make a video of each student's final test of their boat. The student will explain the process that led to the completed sailboat. The video will be published online through a google folder shared to parents.

## **EVALUATE**

- Students will perform final test of their sailboats and record their evaluation of the performance. Did it sink or float? Was the sail efficient? Did the mast hold the sail? Did the body of the boat keep the water out? Student self-evaluation sheets will be added to Discovery Journals.
- Identify land and water on a globe and on a map.

## **ELA Connections**

- **Phonics:**
  1. Long and short vowels (sail, boat, float, etc.). Make an anchor chart of words related to the sink or float predictions and observations. Highlight words that fit the 2 vowel rule. Students will use this for their project word wall. Students will use this anchor chart for support while writing about their experiences. *The chart will be revisited each day* and discussed/added to as needed.
  2. Stretch words out slowly and listen to sounds. Write the letters that make those sounds to solve spelling of words we want to put on our project word wall.
- **Interactive Writing:**
  1. The class will make an anchor chart size model project journal. Different students will take turns writing in the book daily.
- **Shared Writing:**
  1. Students and teacher will create the project word wall together. Students will dictate the words that should go on the word wall chart and the teacher will write them.
- **Writing: During writing workshop and centers...**
  1. Students may write personal narratives about their experiences related to the sailboat project.
  2. Students may write teaching books telling others how to design and create a sailboat.
  3. Students will make lists using words and/or drawings indicating what materials they believe are needed/materials they choose to use/materials that did not work/materials that are used to correct problems.

4. Students will record predictions and experiment outcomes related to whether or not various objects will sink or float. Recording sheets will be added to Discovery Journals.
5. Students may write teaching books explaining how to either draw or read a map.

- **Shared Reading:**

Choral read model project journal daily (edit, add to daily).

**Project Math Connections** – Math Lessons will be taught daily in addition to the math experience students gain through the sailboat project.

- **Measurement:**

1. Students will predict, discover, discuss, explain and/or record whether or not the sail of the boat is bigger, longer, shorter, taller, lighter, heavier than, the same weight as the body of the boat. Students may use balance scales or their own judgement based on the feel of items in their hands to determine weight comparisons. Students will use endpoints to determine size comparisons.
2. Students will predict, discover, discuss, explain and/or record which type of material should be used to make the mast and sail of the boat. Should the mast be longer than, shorter than, the same as the length of the body of the boat? Should the sail be large or small, how many sails should be used?

- **Geometry:**

1. Students will predict, discover, discuss, explain and/or record what shape will be most effective for the body of the boat, for the sail of the boat, and for the mast of the boat. (Advance students may discover that a larger flat surface with edges to keep out water works best for keeping afloat. This provides prior knowledge that will help them gain understanding in surface tension later.)

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