Katelyn Baumgartner

**Engineering Science Lesson**

**Grade:** 2nd Grade

**Subject Area:** Science

**Materials Needed:** clip boards, rubrics, scoring sheets, pencils, kiddie pool, water, LEGO characters, LEGO blocks, popsicle sticks, napkins, rubber bands, paper clips, glue, tape, balloons, bendy straws, shoelaces, scissors, paper plates, paper, dixie cups, empty water bottles, toothpicks, picture books about boats and rafts (any other materials the teacher feels could help students create their rafts)

**Standard:**

* **K-2-ETS1-3** Analyze data from tests of two objects designed to solve the same problem to compare strengths and weaknesses of how each performs.
* **2. RI. 5** Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.
* **2.W.1** Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section.
* **2.SL.1** Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.

**Objectives:**

* Students will work in groups to research, design, create, and evaluate rafts.
* Students will create flotation devices to test against one another.
* Students will use book features such as captions, glossaries, and pictures as inspiration when designing their rafts.
* Students will analyze the results achieved by their creations to compare strengths and weaknesses in their designs.
* Students will write a short opinion papers comparing the strengths and weaknesses of the two rafts they observed.

**Learning Activities:**

* Alright students, now it is time for science.
	+ *Teacher motions to the table of materials.*
* What do you all see in front of me?
	+ *Students will list items they see on the table.*
* Well I see everything you need to create a raft.
* A raft is something that people can use to safely cross water.
* You are all engineers today and your job is to create a raft that will help Fred and Bob (the LEGO characters) cross the river with their treasure chest.
* Now, we all know that if we put our heads together we are smarter than any one of us alone. This is why I have already decided who the teams of engineers will be.
	+ *The teacher could group students by proximity or according to ability. If grouping students based on their abilities, make sure each group has a variety of ability levels (high fliers, average performers, and students who require more support or time).*
	+ *Groups should each include around 4 students. Groups will all be given the same initial materials. Students can choose not to use some of the materials or can request additional quantities of the materials they already have.*
* Before starting any great experiment, engineers need to get together, think about their ultimate goal and talk about different ways of accomplishing this goal.
* Right now I am going to give you each 5 minutes to think about how you would make the perfect raft. This raft can only be powered by your breath. This means that the only thing that will push it across the river is your group standing behind it and blowing on it.
* I have some books at the front of the room that you can take turns taking back to your groups to look at. These books have pictures of different types of rafts and boats that might help you come up with a successful design. Pay attention to the captions: they might give you some helpful information to considering when creating your own rafts.
* What are some of the things we are seeing in common with many of these pictures?
	+ *Teacher will make a running list on the board of answers given by students.*
* Why do you think some of these characteristics would be helpful? Why would we need a sail?
	+ *Students could list things like sails, the shape of the front, inflatable rafts, oars, etc.*
* I need you each to take out a pencil and I will give you a blank sheet of paper to draw your idea. Be sure to label the parts so you can explain your drawing to your group and why you think this would be a good idea.
	+ *Each student could be assigned a number within his or her group which would not only give order to the presentations of their drawings but could also be used to assign certain roles (recorder, 1st presenter, raft drafter, etc.).*
	+ *Groups will be given 8 minutes to draw and talk through their designs. A timer will be projected and the teacher will give verbal notices of remaining time. Teacher will also go around asking groups about their designs and reasons for certain features. The teacher may also give suggestions for improvement or provide insight in design flaws through asking questions such as “Would this cause…?”*
* Now that you have all gotten the chance to see and hear about your group’s designs you get a chance to tell each other which parts you think should be used in making your raft. You will all need to vote on a final design.
	+ *Each group will be given a tub of the materials needed.*
	+ *Students will be given time to work on assembling their rafts. This process could take quite a bit of time due to drying of glue and may take more than one day’s worth of science time to complete. Give approximately 15-20 minutes on day one.*
* I see most of you are coming close to completing your creations. I will now give you all the opportunity to test them out before we test them against each other. If you see that something is not working like you want it to, you will still have some time to make changes.
	+ *Groups could be given smaller tubs of water to test their designs at the back of the room.*

**Assessment:**

* All groups would get together to watch the results of the rafts they had designed.
	+ Actual demonstrations will take place on the playground using a kiddie pool filled with water.
* Each group would be assigned 2 other group projects to pay particular attention to.
	+ Students would each be given clipboards and two Likert Scale sheets to use to rate each raft. (example of Likert Scale on the next page—this scale will not actually be graded)
	+ Students would be analyzing two other groups instead of comparing their own design against someone else’s in order to avoid any personal biases.
	+ Once students have scored the two groups using the scoring sheets they will each individually write out a summary of the strengths and weaknesses of each design.
* Upon completion of the checklists, all members of the group will regroup and discuss what they had written down.
	+ After everybody has gotten a chance to share their opinions with the group they would be instructed to come up with one group analysis of the 2 rafts.
		- They would share only what they found to be the strengths and weaknesses of each and not if they felt one was better than the other. Any personal preferences could be written down but not stated aloud to cause conflict or hard feelings between groups.
* Students would be assessed on their completion of the assignment using the rubric found on following pages.

**Student Instructions for Assessment**

* Okay class, now it is time to put our creations to the test.
* As you can see, on the board I have written which groups you will be scoring. Group 1, you will be scoring Group 2 and Group 3 using scoring sheets. Group 2, you will be scoring Group 3 and Group 4. Group 3, you will be scoring Group 4 and Group 1. Group 4, you will be scoring Group 1 and Group 2.
	+ *This scoring sheet will not actually be graded but should serve as a guide for the students when writing their analyses.*
	+ Now, I have handed out the scoring guides. Before we go outside to test our rafts I want you to write your names on these papers and write the number of the groups you are scoring in the group number line so you don’t forget. I also want us to run through the sheet and make sure that we all understand what we are going to do. We will all be watching all of the rafts but you are only scoring the two groups I have assigned to you. These scoring sheets have five qualities for you to score. Visual Design means that it is asking you if you think this raft is nice looking. If you think it is really nice looking, give it a high rating of a 5. If you do not like the way it looks, give it a low rating of a 1. The next quality is Floats. If it floats the entire time it is in the water it should receive a 5. If it does not float at all, give it a 1. If it floats for some of the time but then sinks it could be a 2, 3, or 4 depending on how long it stayed above water. Distance Traveled is asking if it made it all the way across the pool. Speed refers to how fast the raft traveled. 5 means very fast and 1 means it did not move. The other numbers would be given for somewhere in between. Strength is asking if the raft stayed together in the water and if it was strong enough to hold the two LEGO guys and the treasure chest. I also want you to defend your score for each one.
	+ Does anybody have any questions?
	+ Later these sheets will help you with the next part of the project where we compare the strengths and weaknesses of the designs you saw to write a short explanation that you will share with your classmates in a short presentation.
* Alright. If we all understand what we are supposed to do we will go outside and test our rafts.
* Now that we have seen all of the rafts in action and had time to complete our scoring guides I want you to take a few minutes at your desks to write a summary of the strengths and weaknesses of each raft. I want you to compare and contrast these designs as well.
	+ Okay. I see you are finishing up your summaries. I will give you one more minute to finish up any thoughts. Next, I want you to get back into your groups and discuss what you wrote.
	+ Now I want each member of your group to share one strength and one weakness from one of the rafts you scored. That means we should hear 2 strengths and 2 weaknesses of each design. I only want to hear strengths and weaknesses, I do not want you to say which was your favorite or if you did not like one. We all did our best and they were all great designs.

**Accommodations:**

* *For students who are English Language Leaners (early stage) or Non-Verbal:* Have these students draw pictures for each category instead of using the Scoring Sheet. Divide a piece of paper into 5 portions with a heading for each category and allow space for a drawing under each one. Also, conference with these students individually to ask them to explain their scoring sheet using the cards found on the pages below and compare the two designs.
* *For students with ADHD:* Designate these students to be the ones to gather supplies for the groups. Allowing time for these students to move about the room during the activity will allow them to come back and focus on the important parts.
* *For High Fliers (students who finish early)*: If there are at least two students who have finished early, have them practice reading their analyses with each other before presenting their findings to the group. **OR** Ask these students to write a short fictional narrative about the adventures Fred and Bob take on their raft.  **OR** Have these students write what they would like to change about their own rafts or the ones they scored to improve performance. (Best option.)
* *For Visually Impaired Students*: Increase the font on the Scoring Sheet and allow these students a front row view of the presentations of the rafts. Also, allow these students to type their summaries instead of writing them using an oversized keyboard.

**Raft Scoring Sheet**

Your Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Group # you are rating: \_\_\_\_\_\_\_\_\_\_\_\_

*Circle the number you think this raft deserves for each category. Then, explain your rating below.*

***1****= More than 3 errors, not successful* ***2****= 3 errors, somewhat successful*

***3****= 2 errors but still successful* ***4****= 1 error but successful*

***5****= No errors, very successful*

**Visual Design** 1 2 3 4 5

Why? ­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Floats**  1 2 3 4 5 (Multiply Score by 2)

Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Distance Traveled** 1 2 3 4 5

 Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Speed** 1 2 3 4 5

 Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Strength**  1 2 3 4 5 (Multiply Score by 2)

 Why? ­­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Total Grade:** *(Add up all of the numbers you circled.)* ­­­­­\_\_\_\_\_\_\_\_\_/35\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CATEGORYStudent’s Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | 1 | 2Total Grade:\_\_\_\_\_\_\_/28 | 3 | 4 |
| Oral Presentation*(Score x2)*  | Student did not participate in oral presentation of the analysis. | Student mumbled through presentation. Explanation was hard to hear and understand. Student made no eye contact with the audience. | Student was easily understood. Presentation was clear and loud. Presentation involved minimal eye contact with the audience. | Student showed good presentation skills. Presentation was clear and loud. Student made eye contact with the audience throughout presentation. |
| Participation | Student participated in 1 or fewer of the following aspects of the lesson: design, construction, presentation, evaluation. Papers were not completed **or** not submitted.  | Student participated in 2 of the following aspects of the lesson: design, construction, presentation, evaluation. Papers were completed and turned in. | Student participated in 3 of the following aspects of the lesson: design, construction, presentation, evaluation. Student submitted all completed papers. | Student actively engaged in the design, construction, presentation and evaluation of the rafts. All papers were completed and turned in.  |
| Completion of Scoring Sheet  | Scoring Sheet is incomplete. None of the scores are supported. | Scores were given but 3 or 4 of them were weakly unsupported. | Scoring Sheet is complete. 1 or 2 scores are partially supported. | Scoring Sheet is complete and accurate. All scores are supported and defended. |
| Final Written Analysis*(Score x3)* | No complete sentences Many errors in spelling and grammarAddressed only strengths or weaknesses or did not compare the two designs | Complete sentencesErrors in spelling and grammarCompared designs but did not address specific strengths and weaknesses | Complete sentencesFew errors in spelling and grammarAddressed strengths and weaknesses of both but did not compare designs | Complete sentences (capital letter and punctuation). Proper spelling and grammar Compared two groups by addressing strengths and weaknesses of each design |

Sink



Float

Yes

No



Strong

Weak



Fast



Slow



Long Distance



Short Distance