

Lesson: Science Grades 4-6

Scientific Inquiry



Raft Design 101

Overview:

Students work in teams of 2 to design and test a raft they create using natural materials to carry 2 clay figures representing Huck Finn and Tom Sawyer the distance of the river. During the investigation, the team must choose the materials they will use in the construction of the raft, actually construct it, and then test it in the river. Data of the speed and traveling observations will be collected for each team and the results will be compared and evaluated. The students then select the raft that they would choose to ride down the river if they were Tom and Huck and provide justification for their choice.

Learning Outcomes:

National Standards:

Physical

Motion and forces

Science and technology

Abilities of technical design

Abilities to distinguish between natural objects and manmade objects

Scientific Inquiry

Abilities necessary to do scientific inquiry

Identify questions and concepts that guide scientific investigations

Design and conduct scientific investigations

Ohio Strand Benchmarks:

Science and Technology

Benchmark A

Grade 4

Indicators 1, 2

Benchmark B

Grade 4

Indicator 3

Grade 5

Indicators 2, 3

Grade 6

Indicator 5

Scientific Inquiry

Benchmark A

Grade 4

Indicator 1

Grade 5

Indicator 1

Grade 6

Indicators 1, 2

Benchmark B

Grade 4

Indicator 2

Grade 5

Indicator 2

Grade 6

Indicators 3, 4

Benchmark C

Grade 4

Indicators 3, 5

Grade 5

Indicator 3, 5, 6

Scientific Ways of Knowing

Benchmark A

Grade 4

Indicator 1

Grade 5

Indicator 1

Benchmark B

Grade 4

Indicator 2

Grade 5

Indicators 2,3

Benchmark C

Grade 4

Indicator 4

Grade 6

Indicator 3

Getting Started:

Materials:

- Stick of clay, one per team of 2 students
- 6" aluminum gutter, 8 ft long, with one end blocked
- hose connected to continual water source
- stopwatch
- data collection chart, individual and enlarged for the class
- team instruction page
- Colored string, twine

Technology:

Data collection could be on the computer with students creating their own table for recording their data.

Use the video camera to record each river journey. Review to make comparisons if needed.

Use the digital camera to take pictures of each raft to be used for identification on the class chart.

Vocabulary:

- Mass
- Observation
- Inference
- Data collection

Lesson:

Orientation activity:

1. Show video segment from a river rafting event, could be white water rafting or simply a canoe type trip.
2. Discuss with students the construction of the rafts used in the video segment and what natural materials might be used to construct a similar raft.

Learning activity

1. Select or assign team partners and numbers or names. Handout team instructions.
2. Provide time for each team to discuss, design, draw, and construct their raft for the river journey of Tom and Huck. Suggest that the team conduct a test float in a tub of water and then make changes to the raft if needed.
3. As students prepare their rafts, hang the class chart for recording data. Once the construction is finished, each team records the mass of their raft, the mass of their combined figures (using all the clay), and the materials they used to construct the raft.
4. Set up the gutter as the river. Enclose the lower end so that running water will spill over it gently. Place pieces of wood or blocks under the upper end to create a slope. (The area where you will conduct the river journeys may require you to modify the slope.) Be sure that

running water will continue to flow through the gutter at a steady rate without overflowing the sides, only the bottom. Mark the beginning point just below the upper end and the end as the lower point where it spills over using colored string or twine across the top edge of the gutter. This will be the distance that each raft must travel carrying the clay figures.

5. Time to travel the river! Ask students to observe the gutter that will serve as the river. What might happen during the test that would be similar to a real river, different than a real river? Each team places their raft and figures at the starting point, holding them in place until GO! is shouted by the rest of the class. A student acts as official timer clicking the stopwatch once when they start and again when the raft crosses the end. This time is recorded on the class chart. If the raft gets stuck in the river, the team may use any means they like to get it going except touching it and/or picking it up. If it capsizes, the boys and the raft are lost. Time permitting, allow those teams to make a second run using the same raft and clay figures. Record this run in a different color on the chart to indicate that it was not the first attempt.
6. Complete the class chart by indicating whether the team needed to help the raft along or if it made the journey self-propelled. Calculate the average time that the rafts took traveling the river.
7. Use the data on the class chart to update individual charts and as a basis for a discussion about the events. Looking at the chart, identify the comments that are observations and those that are inferences. Review what makes an inference and an observation. Mark the comments with an "O" for observation that can be proved and an "I" for inference based upon an observation. Lead students to justify their inferences with a stated observation. Ask students to identify similarities and differences in the rafts and their journeys. What materials seemed to produce more successful rafts in terms of time? in terms of movement? What materials seemed to deter the success of the journeys? What relationship between the mass of the raft and the journey can be made? Why did different rafts produce different results? Use a highlighter or another symbol to indicate some of these comparisons on the class chart.
8. Students use the data they collected individually and compared from the class chart to evaluate the success of each raft. They then write a paragraph explaining which raft they would want to ride in the river if they were Huck and Tom. Observations from the events will be used to justify their selection.

Handouts:

- Raft Design 101 Data Collection Chart
- Team instructions

Evaluation and Follow-Up:

Assessment tools and methods:

Observation of students during planning, construction, and testing shows their ability to follow procedures, cooperate within the team and class, and participate in activities. These make great observational notes.

The final paragraph will provide a glimpse of individual student thinking and processing of the data and evaluation of their peers. It will demonstrate the student's ability to make a decision and to defend that decision using data and facts. This evaluation could also serve as a writing sample.

Interdisciplinary connections:

Math

Students determine the mass of the figures and raft and time the journey down the river. Comparisons in times are made to draw conclusions about the success of the rafts and their construction

Language Arts

Written expression of observations and inferences, interpreting and explaining data, evaluating work of peers and justifying choices.



Raft Design 101

Team instructions



Even if you have never been river rafting, you may have an idea of the type of raft that you would want to use to be safe. Tom Sawyer and Huck Finn are going to rely on your design team to decide what natural materials your team thinks should be used to build a safe raft for the boys to get to Sullivan's

Island safely. It's time to put on your thinking caps to help the boys solve this problem. Use this team instruction sheet as your guideline during your discussion, planning, and construction of your raft. It will serve as an excellent checklist to be sure that you have covered all angles in the construction of a raft for the safe passage of the boys. Oh, by the way, you have a stick of clay to use to make the boys, but most of your time should be devoted to the raft itself.

To be successful, you must work as a team. Follow these guidelines to help you design and construct your raft.

- Brainstorm a list of natural materials that members of your team could collect at home that could be used to construct a raft. So what is a natural material? Something that has not been made by man is the idea; like grass, twigs, leaves, moss, etc. Save the list, you will need it later!
- Discuss ways to build a raft, using these materials, that will carry 2 clay figures (representing Tom Sawyer and Huck Finn) made from a stick of modeling clay, along a "river" that is about 6 inches wide and 8 feet long. The river, having a steady flow of water, will test your design and navigation skills. And yes, it is a race...a race against the clock. We will be timing how long it takes for your raft to cross the finish line. Come to a



consensus in regards to the design and materials to collect to be used. (HINT! HINT! HINT!) It might be wise to collect more materials than you originally think will be needed.

- Members of your group collect the designated materials and bring them to class to construct the raft. Yes, you will do it here at school to insure that each of you has a hand in its construction and I will be taking notes of your participation in the process. 😊

- Build it!!! Every team member plays a part in the raft construction. I am looking within a team of problem solvers. Record an amount of each material that you used next to that item on your original brainstorm list. Oh, yes, remember that you need to use an entire stick of modeling clay to make Tom and Huck, your passengers. Each group has the same amount of clay, what is that called when something stays the same in an investigation? Why do you think this is so?

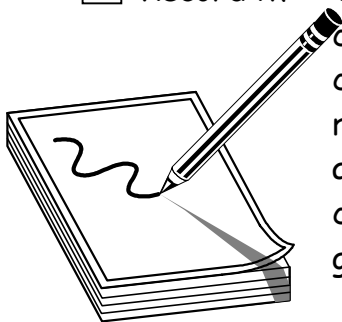


member plays a part in the raft for cooperation and creativity solvers. Record an amount of next to that item on your yes, remember that you need modeling clay to make Tom Each group has the same

- Test it! Use the tub of water to test your raft. What will you conduct a test to determine? If it doesn't perform in the way that you intended, what can you do? Talk it over with your group. Some one may have the ultimate Ah Ha! To solve your problem.

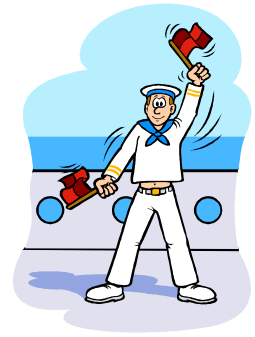
- Measure it! Find the mass of the raft by itself and Tom and Huck. Record these on your individual data collection charts next to your group number/name. Now do some Math, yep! In Science class! Find the total mass of your raft and the "boys". Record it on your individual data collection charts.

- Record it! Continue completing the basic information on your data collection chart by listing the materials that you used to construct your raft. Quantities would be nice! Find a way to represent what you used in mathematical terms, look back at your brainstorm list. Add all of this information to the class data collection chart. As other groups post their group's data, add it to your individual chart.



- Let's go rafting! Once all groups have completed the design and construction process, you will have an opportunity to set sail. Remember that we will time your raft as it travels along the river. Be prepared to help your raft along if it just doesn't want to go... keep in mind that once it touches the water, no one may touch it or pick it up again until it has crossed the finish line. Have a plan in mind in case this happens to your group.

- Collect data as each group sets sail. Record what your qualitative observations. When your group is sailing, the rest of the class will record observations for you. The official timekeeper will post your sailing time.



Raft Design 101 Data Collection Chart

Picture	Group	Mass of raft	Mass of figures	Total mass of raft and figures	Natural raft materials	Time, start to finish	Observations/ Inferences
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						