VARIABLE RIVERS: GUIDE

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Objectives:

*Students will work in small groups to develop a way to isolate a variable and perform an experiment.

*Students will collect and analyze data to determine the effects of river variables.

*Students will compile information and create a presentation for the class.

Grade Level:
6-12th grade

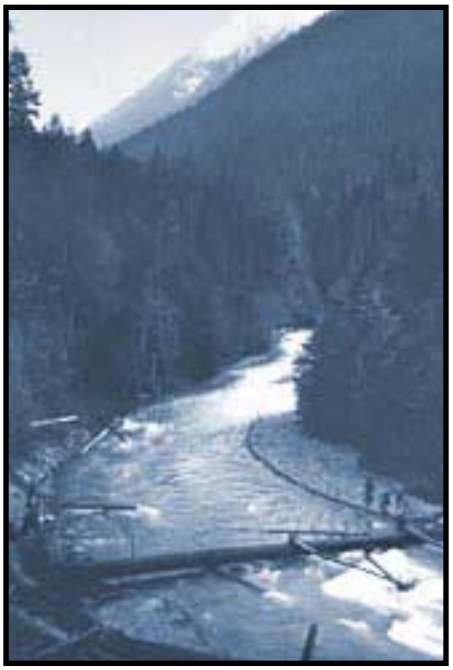
Materials:
Plastic shoebox
Graduated cylinder
Sand
Ruler
Water
Lab worksheets

Preparation:
One shoebox and set of worksheets per group of three students.

Time:
Two class periods

Overview:

There are several variables that affect the size and shapes of rivers. The amount of the water present in the river, the velocity of the water, and the angle (steepness) of the river bed control how a river erodes and deposits sediment. The three variables work together and change the size and shape of rivers. River depth, river width, and the size of the delta are determined by the erosion and deposition of sediment. This activity is designed to be used as a supplement to related material. Students will be working in small groups to test an isolated variable; they will test either amount of water, velocity, or steepness of the river bed. Students will then compare their results with other groups who tested the same variable, before presenting their information to the class.



Rivers' depth, width, and amount of erosion are affected by several variables. Students will have an opportunity to test how the amount of water, its velocity, or the angle of the bed affects the shape and size of the river.

Introduction:

Introduce the concept of rivers with different sizes and shapes, by asking the following questions: "What do rivers look like?", "Do rivers change shape?", and "What factors affect how rivers look?". Have the students draw on the board what they think a river looks like. In this lesson, continue to encourage students to use critical thinking skills. This lesson is designed to develop ways to perform experiments and analyze data. Once students complete their experiments, they will discuss their results in a large group and present the information to the class.

It is important to emphasize that all three of the variables work together to shape rivers. The amount of water, velocity of the water, and the angle of the river interact to shape the river. The is a great activity to begin a unit on rivers.

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VARIABLE RIVERS: GUIDE

For this lesson:

Consider making the "Outline" and "Conclusion" pages as overheads. Students can write the outline and conclusions in their science journals.

Using the "Conclusion" page, student groups will create an overhead or presentation to teach the class about their variable.

Grouping:

Divide the students into groups of three. Have one group member select a variable that they will measure at random (using the slips provided), or assign each group a variable to test. Make sure that there is an even distribution of each variable. Each group will then be given a Variable River worksheet and the lab materials. Give each group member a designated role: data recorder, data collector, and experiment performer. Have students rotate roles so each member has a opportunity to do each task. Quickly discuss the responsibility of each role.

Second Grouping:

After the groups of three have completed their experiment and made their conclusions, regroup the class. Have all the student groups that worked on the same variable come together to discuss their results. There should now be three large groups in the class, one for each of the following: Amount of Water, Velocity of Water, and Angle of the River. Once they discuss and solidify their conclusions about what happens to the depth of the river, width of the river, and size of the delta, have the students follow the "Conclusion" page to create a presentation or overhead to the class.

Setup:

When students are ready to begin their experiment, have them obtain the materials. This experiment works well using a plastic shoebox or plastic container of similar likeness. Pile 2-3 cups of sand on one side of the plastic container. Have the students use their fingers to dredge one straight river down the pile of sand. They should take initial measurements of the width, depth, and size of the delta (length or width). Encourage students to follow the Hint Sheet and to make data tables. If there is no sink available in the room, two five-gallon buckets may substitute; use one buck for clean water to pour down the "river" and the second bucket for students to discard their dirty water after each trial run.

Conclusion:

In three large groups, representing each of the three variables, have the students present their findings to the class. Once all the students have all the information for each of the variables, challenge them to make connections between them.

What is the relationship between the velocity of the water and the angle of the river?

What is the relationship between the width and depth of fast moving rivers?

What are common characteristics of narrow rivers?

What are common characteristics of wide rivers?

What characteristics do rivers have that produce large deltas?

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VARIABLE RIVERS: ANSWERS

Answers:

a. what happened to the width of the river
b. what happened to the depth of the river
c. what happened to the delta
d. where did most of the sediment erode
e. anything else interesting

Amount of Water

The more water present in the river causes the following:

a. the river gets wider
b. the river gets more shallow
c. the size of the delta increases
d. the sides of the river erode the most
e. student answer

Velocity (speed) of Water

The faster the river water flows causes the following:

a. the river remains the same width (or slightly wider)
b. the river gets deeper
c. the size of the delta increases
d. the bottom of the river erodes the most
e. student answer

Angle (steepness) of the River

The steeper the angle of the river causes the following:

a. the river remains the same width (or slightly wider)
b. the river gets deeper
c. the size of the delta increases
d. the bottom of the river erodes the most
e. student answer

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VARIABLE RIVERS: OUTLINE

There are several variables that affect the size and shapes of rivers. The amount of the water, the velocity of the water, and the angle (steepness) of the river control how a river erodes and deposits sediment.

Purpose:

In this experiment, you will use a plastic container, sand, and water to see how different variables affect the size and shapes of rivers.

Directions:

1. Form groups of three.
2. Have one group member select a variable card and get a Hint Sheet.
3. Everyone must be an active group member. Rotate roles: data recorder, data collector, and experiment performer.
4. Everyone must do each role. Therefore, there should be three different handwritings on your lab write up.
5. Using the Hint Sheet, determine how you manipulate your variable in your experiment.
6. Follow the outline below. When you have completed your procedure, notify your teacher.

Outline:

For this lab activity, you will use the following outline to write up your experiment fresh piece of paper. Write all your names, roles of each group member, and your period at the top.

Title: (Should include your variable)

Problem: (This is a question that you want to answer in your experiment)

Hypothesis: ("We think that when we……. this will happen……")

Procedure: (Write up your procedure exactly how you will run this experiment)

Observations/Data: (What are you measuring? Make a table and use your Hint Sheet)

Conclusion: (When you manipulated your variable, what did you discover?)

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VARIABLE RIVERS: CONCLUSION

There are several variables that affect the size and shapes of rivers. The amount of the water, the velocity of the water, and the angle (steepness) of the river control how a river erodes and deposits sediment.

Summarize:

Answers should include the following:

a. what happened to the width of the river
b. what happened to the depth of the river
c. what happened to the delta
d. where did most of the sediment erode
e. anything else interesting

Amount of Water

The more water present in the river causes the following:

a.
b.
c.
d.
e.

Velocity (speed) of Water

The faster the river water flows causes the following:

a.
b.
c.
d.
e.

Angle (steepness) of the River

The steeper the angle of the river causes the following:

a.
b.
c.
d.
e.

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VARIABLE RIVERS

HINT SHEET: ANGLE (STEEPNESS) OF THE RIVER

1. Remember you are only testing ONE variable, the angle. This means you must keep the velocity of the water and the amount of the water constant.

2. You need to change the angle of incline for your river. Consider stacking books on one end to get different heights.

3. When manipulating your variable, run your experiment when the river box is:
    a. horizontal/flat
    b. propped up with one book
    c. propped up with multiple books

4. Your problem should address something you are trying to figure out or solve.

5. When writing your procedure, make sure you include how you are manipulating your variable. Write this procedure exactly how you perform your experiment so anyone could repeat it.

6. When observing and data collecting, measure what is happening to the river. What changes when you manipulate your variable? You need to measure **each** of the following changes that will occur:
    a. width of the river
    b. depth of the river
    c. size of the delta

7. Since you are measuring changes in your river, you must record the original width of the river, depth of the river, or size of the delta so you can compare it to your results.

8. Make sure you set up a data table to include your trials and their results. Remember you are measuring what happens/changes to the river as your manipulate your variable.

9. Your conclusion must state whether or not your hypothesis is correct, summarize your data and observations, and use the data to justify your results.

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VARIABLE RIVERS

HINT SHEET: AMOUNT OF WATER

1. Remember you are only testing ONE variable, the amount of water in your river. This means you must keep the velocity of the water and the angle of the river constant.

2. Change the amount of water for your river. Use the graduated cylinders to measure how much water you will use for each trial in your experiment.

3. To manipulate your variable, use different amounts of water:
    a. 50 mL
    b. 100 mL
    c. 150 mL

4. Your problem should address something you are trying to figure out or solve.

5. When writing your procedure, make sure you include how you are manipulating your variable. Write this procedure exactly how you perform your experiment so anyone could repeat it.

6. When observing and data collecting, measure what is happening to the river. What changes when you manipulate your variable? You need to measure **each** of the following changes that will occur:
    a. width of the river
    b. depth of the river
    c. size of the delta

7. Since you are measuring changes in your river, you must record the original width of the river, depth of the river, and size of the delta so you can compare it to your results.

8. Make sure you set up a data table to include your trials and their results. Remember you are measuring what happens/changes to the river as your manipulate your variable.

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VARIABLE RIVERS

HINT SHEET: VELOCITY OF WATER

1. Remember you are only testing ONE variable, the velocity (speed) of the water. This means you must keep the amount of the water and the angle of the river constant.

2. You need to change the velocity of water for your river. Consider pouring the water out of the graduated cylinder at different speeds.

3. When manipulating your variable, consider pouring out the water by:
    a. 3 seconds (fast)
    b. 10 seconds (slow)
    c. 20 seconds (really slow)

4. Your problem should address something you are trying to figure out or solve.

5. When writing your procedure, make sure you include how you are manipulating your variable. Write this procedure exactly how you perform your experiment so anyone could repeat it.

6. When observing and data collecting, measure what is happening to the river. What changes when you manipulate your variable? You need to measure **each** of the following changes that will occur:
    a. width of the river
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VARIABLE RIVERS

Amount of Water

Velocity of Water

Angle (steepness) of River

Amount of Water

Velocity of Water

Angle (steepness) of River

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Velocity of Water

Angle (steepness) of River

Amount of Water

Velocity of Water

Angle (steepness) of River

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NCED TEMPLATE

Minnesota Academic Standards
Science Content Standards: K-12

GRADE 6
I. HISTORY AND NATURE OF SCIENCE
B. Scientific Inquiry

The student will understand that scientific inquiry is used in systematic ways to investigate the natural world.

GRADE 7
I. HISTORY AND NATURE OF SCIENCE
A. Scientific World View

The student will understand that science is a way of knowing about the world that is characterized by empirical criteria, logical argument and skeptical review.

B. Scientific Inquiry

The student will design and conduct scientific investigations.

GRADE 8
I. HISTORY AND NATURE OF SCIENCE
B. Scientific Inquiry

The student will understand that scientific inquiry is used by scientists to investigate the natural world in systematic ways.

GRADE 8
I. HISTORY AND NATURE OF SCIENCE
B. Scientific Inquiry

The student will use multiple skills to design and conduct scientific investigations.

GRADE 8
III. EARTH AND SPACE SCIENCE
A. Earth Structure and Processes

The student will identify Earth's composition, structure and processes.

GRADE 9–12
III. EARTH AND SPACE SCIENCE
A. Earth Structure and Processes

The student will understand that the interactions of the atmosphere, biosphere, lithosphere, hydrosphere and space have resulted in ongoing change of the Earth system over geologic time.