STUDENT WORKBOOK

for

Argument-Driven Inquiry

in

Fourth-Grade Science

Three-Dimensional Investigations

Victor Sampson and Ashley Murphy

NSTA press
National Science Teachers Association

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Movement of Water: Why Can We See the Roots of Trees That Grow Near Rivers or Streams?

Introduction

Trees can be found all over the world. A tree is a plant with a trunk made of wood. The trunk of a tree supports branches that hold leaves above the ground. A tree also has roots. The roots of a tree anchor it to the ground. The roots also make it possible for the tree to collect water and nutrients from the soil around it. Your teacher will have you look at some pictures of trees. Keep track of what you observe when you look at these trees and what you are wondering about as you look at them in the boxes below.

Things I OBSERVED …	Things I WONDER about …

We usually cannot see the roots of trees because they are underground. However, some of the trees that you looked at have roots that you can see. These trees grow near a body of water such as a lake, river, or stream. Trees need water to survive, and the amount of water available at a particular location determines how many and what types of trees are found at that location.

The water found in lakes, rivers, and streams comes from rain and snow. The amount of rain or snow that falls in an area determines the size of the lakes, rivers, and streams in the area. When there is a lot of rain or snow, lakes, rivers, and streams will fill with water and grow bigger and deeper. When there is very little rain or snow, the lakes, rivers, and streams in the area will shrink in size and may even disappear. Water moving in a river or stream can also break rocks and soils into smaller pieces and move the smaller pieces from one place to another. Water can therefore change the appearance of the land in a region.

In this investigation, your goal is to figure out why we often see the roots of trees that are found growing near a river or stream. You will need to create a physical model of a river with trees along it for this investigation. Your teacher will show you how to create your model using a stream table, sand, some pipe cleaners, and water. You can then use your physical model to test out your different ideas about what you think happens to the trees that grow near rivers and streams.

Things we KNOW from what we read …	What we will NEED to figure out …

Your Task

Use what you know about the movement of water over land, how water can move things around, and cause-and-effect relationships to design and carry out an investigation to determine how the movement of water in a river or stream (a *cause*) affects the soil around a tree (an *effect*).

The *guiding question* of this investigation is, ***Why can we see the roots of trees that grow near rivers or streams?***

Materials

You may use any of the following materials during your investigation:

- Safety glasses or goggles (required)
- Plant tray
- Small block of wood
- 10 pipe cleaners
- Funnel pitcher
- Rulers
- Stopwatch
- 1 cm grid transparency
- Wet-erase markers
- Water
- Sand

Safety Rules

Follow all normal safety rules. In addition, be sure to follow these rules:

- Wear sanitized safety glasses or goggles during setup, investigation activity, and cleanup.
- Do not throw pipe cleaners or sand, and do not put these materials in your mouth.
- Immediately clean up any spills to avoid a slip or fall hazard.
- Wash your hands with soap and water when you are done collecting the data.

Plan Your Investigation

Prepare a plan for your investigation by filling out the chart that follows; this plan is called an *investigation proposal*. Before you start developing your plan, be sure to discuss the following questions with the other members of your group:

- What might **cause** the appearance of the trees near rivers or streams to **change**?
- How can we **measure a change** over time?

Investigation Log

Our guiding question:

This is a picture of how we will set up the equipment:

We will collect the following data:

These are the steps we will follow to collect data:

I approve of this investigation proposal.

Teacher's signature

Date

Collect Your Data

Keep a record of what you measure or observe during your investigation in the space below.

Analyze Your Data

You will need to analyze the data you collected before you can develop an answer to the guiding question. To do this, create a graph that shows the relationship between the cause and the effect.

Draft Argument

Develop an argument on a whiteboard. It should include the following:

- A *claim*: Your answer to the guiding question.
- *Evidence*: An analysis of the data and an explanation of what the analysis means.
- A *justification of the evidence*: Why your group thinks the evidence is important.

The Guiding Question:	
Our Claim:	
Our Evidence:	Our Justification of the Evidence:

Argumentation Session

Share your argument with your classmates. Be sure to ask them how to make your draft argument better. Keep track of their suggestions in the space below.

Ways to IMPROVE our argument …

Draft Report

Prepare an *investigation report* to share what you have learned. Use the information in this handout and your group's final argument to write a *draft* of your investigation report.

Introduction

We have been studying _____ in class. Before we started this investigation, we explored _____

_____

_____

We noticed _____

_____

_____

My goal for this investigation was to figure out _____

_____

_____

The guiding question was _____

_____

_____

_____

Method

To gather the data I needed to answer this question, I _____

_____

_____

_____

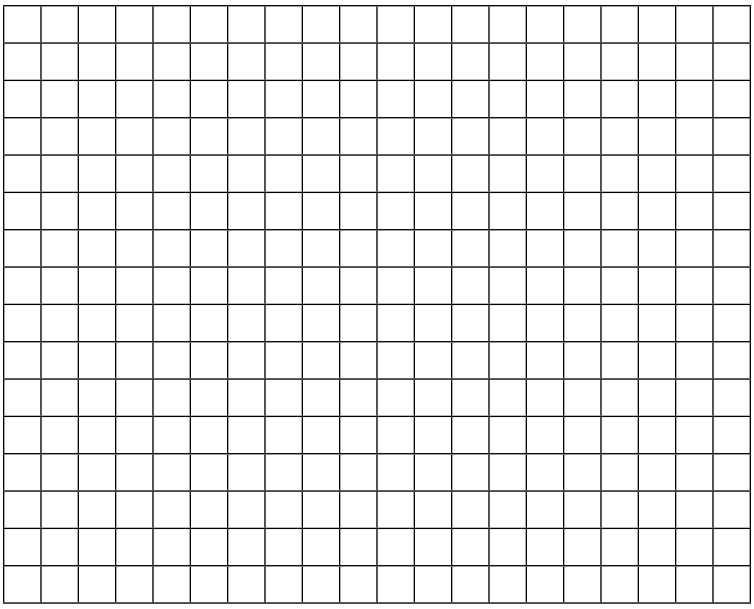
_____

I then analyzed the data I collected by _____

Argument

My claim is _____

The graph below shows _____



This analysis of the data I collected suggests _____

_____

_____

_____

_____

This evidence is important because of several scientific concepts. The first one is _____

_____

_____

_____

_____

_____

_____

_____

_____

Review

Your friends need your help! Review the draft of their investigation reports and give them ideas about how to improve. Use the *peer-review guide* that begins on the next page to guide your review.

Peer-Review Guide

Section 1: The Investigation	Reviewer Rating		
1. Did the author do a good job of explaining what the investigation was about?	☐ No	☐ Almost	☐ Yes
2. Did the author do a good job of making the **guiding question** clear?	☐ No	☐ Almost	☐ Yes
3. Did the author do a good job of describing what he or she did to **collect data?**	☐ No	☐ Almost	☐ Yes
4. Did the author do a good job describing **how** he or she **analyzed** the data?	☐ No	☐ Almost	☐ Yes
Reviewers: If your group gave the author any "No" or "Almost" ratings, please give the author some advice about what to do to improve this part of his or her investigation report.			

Section 2: The Argument	Reviewer Rating		
1. Does the author's claim provide a clear and detailed **answer** to the guiding question?	☐ No	☐ Almost	☐ Yes
2. Did the author support his or her claim with **scientific evidence?** Scientific evidence includes analyzed data and an explanation of the analysis.	☐ No	☐ Almost	☐ Yes
3. Does the **evidence** that the author uses in his or her argument **support the claim?**	☐ No	☐ Almost	☐ Yes
4. Did the author include enough **evidence** in his or her argument?	☐ No	☐ Almost	☐ Yes
5. Did the author do a good job of **explaining why the evidence** is important (why it matters)?	☐ No	☐ Almost	☐ Yes
6. Is the content of the argument **correct** based on the science concepts we talked about in class?	☐ No	☐ Almost	☐ Yes
Reviewers: If your group gave the author any "No" or "Almost" ratings, please give the author some advice about what to do to improve this part of his or her investigation report.			

Continued

Section 3: Mechanics	Reviewer Rating		
1. ***Grammar:*** Are the sentences complete? Is there proper subject-verb agreement in each sentence? Are there no run-on sentences?	☐ No	☐ Almost	☐ Yes
2. ***Conventions:*** Did the author use proper spelling, punctuation, and capitalization?	☐ No	☐ Almost	☐ Yes
3. ***Word Choice:*** Did the author use the right words in each sentence (for example, *there* vs. *their, to* vs. *too, then* vs. *than*)?	☐ No	☐ Almost	☐ Yes

Reviewers: If your group gave the author any "No" or "Almost" ratings, please give the author some advice about what to do to improve the writing mechanics of his or her investigation report.

General Reviewer Comments

We liked …

We wonder …

Write Your Final Report

Once you have received feedback from your friends about your draft report, create your final investigation report in the space that follows.

Introduction

Method

Argument

Investigation Report Grading Rubric

Section 1: The Investigation	Score: Missing	Somewhat	Yes
1. The author explained what the investigation was about.	0	1	2
2. The author made the **guiding question** clear.	0	1	2
3. The author **described** what he or she did to **collect data.**	0	1	2
4. The author described **how** he or she **analyzed** the data.	0	1	2

Section 2: The Argument	Score: Missing	Somewhat	Yes
1. The claim includes a clear and detailed **answer** to the guiding question.	0	1	2
2. The author used **scientific evidence** to support the claim. Scientific evidence includes analyzed data and an explanation of the analysis.	0	1	2
3. The evidence **supports the claim.**	0	1	2
4. The author included enough **evidence** in his or her argument.	0	1	2
5. The author **explained why the evidence** is important.	0	1	2
6. The content of the argument is **correct.**	0	1	2

Section 3: Mechanics	Score: Missing	Somewhat	Yes
1. ***Grammar:*** The sentences are complete. There is proper subject-verb agreement in each sentence. There are no run-on sentences.	0	1	2
2. ***Conventions:*** The author used proper spelling, punctuation, and capitalization.	0	1	2
3. ***Word Choice:*** The author used the right words in each sentence (e.g., *there* vs. *their, to* vs. *too, then* vs. *than*).	0	1	2

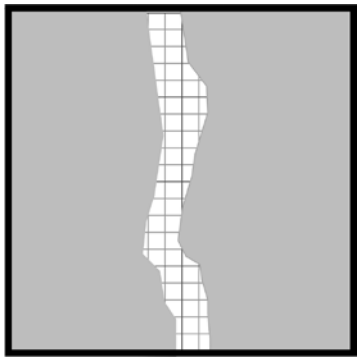
Teacher Comments	
Here are some things I really liked about your report …	Here are some things I think you could do next time to make your report even better …

Total: ____ /26

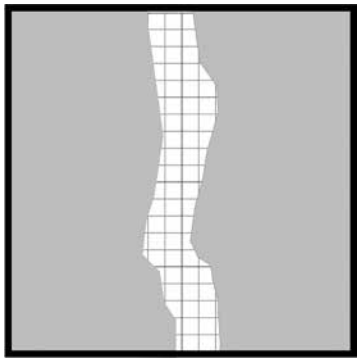
Checkout Questions

Investigation 14. Movement of Water

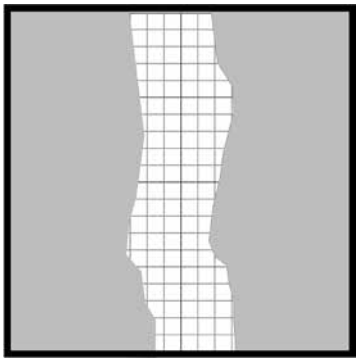
The picture below shows a creek and the land around the creek. The squares in the creek are 30 cm on each side. Use this information to answer questions 1–3.



1. Which picture below (A or B) shows the least amount of soil erosion along the banks of this creek? Circle your choice.

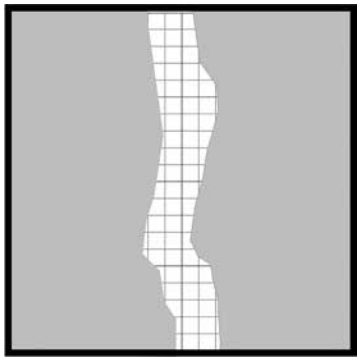


A

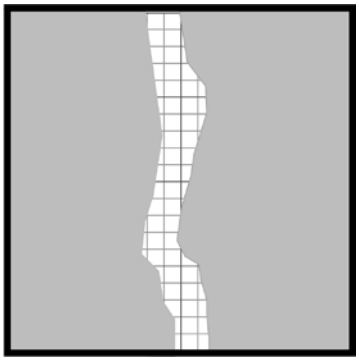


B

2. Which picture below (A or B) shows what the creek would look like after several days of heavy rain? Circle your choice.



A



B

Checkout Questions

3. Explain your thinking. What *cause-and-effect relationship* from your investigation did you use to answer these questions?

Teacher Scoring Rubric for the Checkout Questions

Level	Description
3	The student can apply the core idea correctly in all cases and can fully explain the cause-and-effect relationship.
2	The student can apply the core idea correctly in all cases but cannot fully explain the cause-and-effect relationship.
1	The student cannot apply the core idea correctly in all cases but can fully explain the cause-and-effect relationship.
0	The student cannot apply the core idea correctly in all cases and cannot explain the cause-and-effect relationship.

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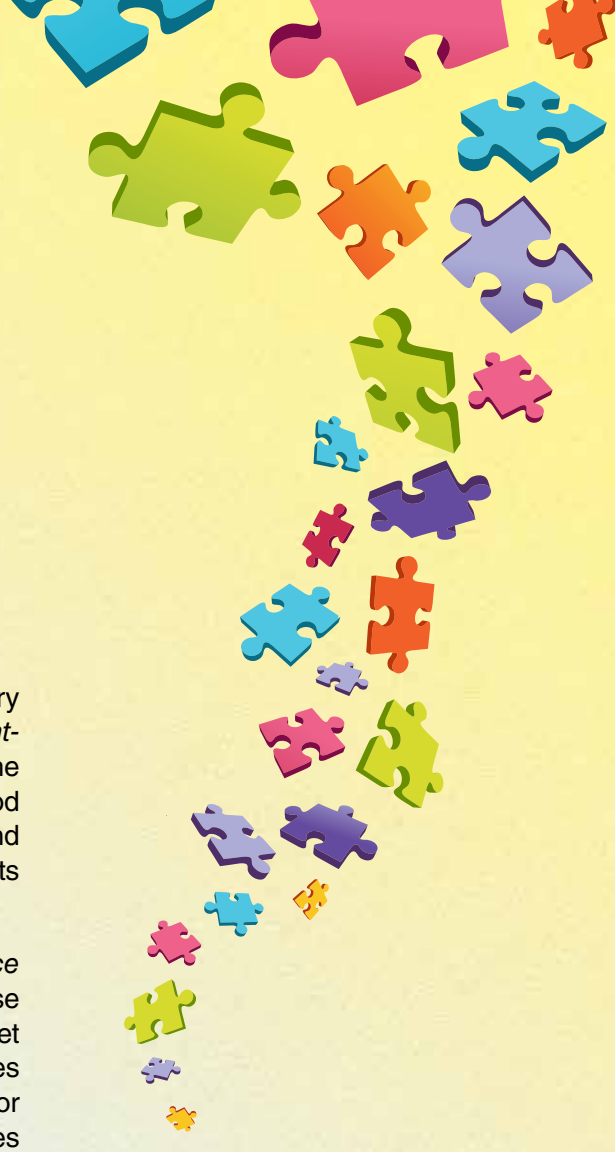

Are you interested in using argument-driven inquiry (ADI) for elementary instruction but just aren't sure how to do it? You aren't alone. *Argument-Driven Inquiry in Fourth-Grade Science* will provide you with both the information and instructional materials you need to start using this method right away. The book is a one-stop source of expertise, advice, and investigations. It's designed to help your fourth graders work the way scientists do while integrating literacy and math at the same time.

The *Student Workbook for Argument-Driven Inquiry in Fourth-Grade Science* has all the student materials you need to guide your students through these investigations. It provides lab details, safety information, and handouts to get your students ready to start investigating. It presents a well-organized series of 15 field-tested investigations designed to be much more authentic for instruction than traditional activities. The investigations cover energy, waves and their application in technologies for information transfer, molecules and organisms, and Earth's place in the universe and systems. Students can investigate questions such as these: How does the energy of a moving object change after a collision? How can you make an electric car move faster? And why do big waves block the entrance to some New Zealand harbors?

The *Student Workbook* is part of NSTA's best-selling series about ADI in middle school and high school science. Like its predecessors, this collection is designed to be easy to use. The lessons also support the *Next Generation Science Standards* and the *Common Core State Standards* for English language arts and mathematics. The book can also help emerging bilingual students meet the *English Language Proficiency Standards.*

Many of today's elementary school teachers—like you—want new ways to engage students in scientific practices and help students learn more from classroom activities. *Argument-Driven Inquiry in Fourth-Grade Science,* with its accompanying *Student Workbook,* does all of this while giving students the chance to practice reading, writing, speaking, and using mathematics in the context of science.

GRADE 4

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