Young Naturalists

Teachers Guide

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"Let's Find Out" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Let's Find Out" by Mary Hoff with illustrations by Stan Fellows. Published in the March–April 2010 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/scientific_method

Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources (including related Conservation Volunteer *articles), copy-ready study questions with answer key, and a copy-ready vocabulary sheet and vocabulary study cards. There is also a practice quiz (with answer key) in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified a to suit user needs. Users are encouraged to provide feedback through an online survey at www.mndnr.gov/education/teachers/activities/ynstudyguides/survey.html. If you are downloading articles from the Web site, please note that only Young Naturalists articles are available in PDF.*

Summary

"Let's Find Out" gives readers an introduction to the scientific method, with emphasis on studies conducted by Minnesota Department of Natural Resources scientists. Students are guided through the systematic thinking process from initial observations and formulation of hypotheses, to experimental design and implementation, to analysis of data communication of results.

Suggested reading levels:	Mid-elementary through high school grades
Total words:	1,376
Materials:	Paper, poster board, pencils, pens, markers, as well as print and online resources your media specialist may provide
Preparation time:	One to two hours, not including time for extension activities.

Estimated instructional time:

One or two 50-minute class periods (not including extensions)

Minnesota Academic Standards applications:

"Let's Find Out" may be applied to the following Minnesota Department of Education standards:

I. Reading and Literature
A. Word Recognition, Analysis and Fluency
B. Vocabulary Expansion
C. Comprehension

II. Writing
A. Types of Writing
B. Elements of Composition
C. Spelling
D. Research
E. Handwriting and Word Processing

III. Speaking, Listening and Viewing
A. Speaking and Listening
B. Media Literacy

Math
Grades 3–5
Data Analysis
Grades 6–11
Data Analysis and Probability

Science
Grades 3–12
I. History and Nature of Science
A. Scientific World View
B. Scientific Inquiry

Arts
Grades K–12
1. Artistic Foundations: Visual Arts
2. Artistic Process: Create or Make: Visual Arts
3. Artistic Process: Perform or Present: Visual Arts
4. Artistic Process: Respond or Critique: Visual Arts

Complete Minnesota Academic Standards are available at www.education.state.mn.us. Teachers who find other connections to standards are encouraged to contact the *Conservation Volunteer*.

Preview

First, pose a question the scientific method might answer. For example, "How do honeybees communicate?" or "Why does the population of wolves (or some other species) rise and fall?" Students' discussion may give you some sense of how well they understand the topic. Next ask students to survey the article. Examine the illustrations. Use the **KWL** strategy (Ogle, 1986) to find out what your students already know (**K**) about the scientific method, what they would like to learn (**W**), and eventually what they learned (**L**) while reading the article and related materials, and through participating in extension activities. You might begin by asking small groups to brainstorm their ideas. Then combine the groups' data to make a class list. Display your **K** and **W** ideas on poster board or paper (see Vocabulary preview). Add to your **L** list as you read and discuss the article. See www.teach-nology.com/web_tools/graphic_org/kwl for a **KWL** generator that will produce individual organizers for your students. Individual organizers may be useful as students read the article for answers to **W** questions. KWL also gives you the opportunity to introduce interdisciplinary connections you will make during extension activities. For example, if you plan to use the article during science or art, you may ask students to review the KWL for concepts that are specific to those disciplines.

Vocabulary preview

See the copy-ready vocabulary list included in this guide. You may wish to modify the list based on your knowledge of your students' needs or the subject you are teaching. Pretesting vocabulary individually, in small groups, or with your entire class can be an effective vocabulary preview strategy. You may then post-test at the conclusion of this activity (see Assessment section below). You may wish to use the study cards found at the end of this guide. Cut along the horizontal line; fold in the middle and tape or staple. Study cards (see *Strategic Tutoring*, Hock, Deshler, and Schumaker 2000) can be applied to any subject area. On one side of the card, in large letters, write a key word or phrase that students are expected to know. In smaller letters frame the word or phrase in a question or statement. On the other side of the card, in large letters, write the answer to the question. Finally, in smaller letters, frame the answer in a question or statement. Blanks are provided to allow you or your students to add new words or phrases.

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). Preview the entire guide with your class before you read the article. You may wish to read the story aloud and complete the study questions in class, in small groups, or as an independent activity. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section). The study questions may be also used as a quiz. Note: Items 4, 7, 8, 9 and the Challenge require varying degrees of critical thinking.

Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first. If time allows, remaining items may be attempted. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Ask students to write a brief essay describing the scientific method, to include steps from observation through communication of results. (2) Provide the scientific inquiry graphic from page 49 and ask students to describe each step. (3) Students may write multiple-choice, true-false, or short-answer questions. Teachers may then select the best items for a class quiz. (4) Posters may depict the studies described in the article. Posters may be presented to the class and/or displayed in the classroom. (5) Students may propose a hypothesis, outline an experimental approach to investigate their question and share their work with classmates in a paper or poster presentation.

Extension activities

1. This article can serve as an excellent supplement to your science fair curriculum. Students may be inspired to try naturalistic studies for their fair projects.
2. See Kids Do Science at www.uga.edu/srel/kidsdoscience/kidsdoscience-fun.htm. This site provides several scientific method activities for younger students.
3. Try sciencespot.net/Pages/classgen.html for junior high–level scientific method activities. Many are copy ready.
4. Check out sciencespot.net/Pages/classgen.html for middle-level PowerPoint presentations, poetry and rap, as well as observation challenges.
5. The National Oceanic and Atmospheric Administration (NOAA, www.education.noaa.gov/sweather.html) has several great activities for elementary through high school.
6. Students may participate in a number of environmental monitoring projects through the

Extension activities continued

National Wildlife Foundation (www.nwf.org/wildlifewatch), the Minnesota Pollution Control Agency (www.pca.state.mn.us/water/clmp.html) or the Minnesota Department of Natural Resources (www.dnr.state.mn.us/eco/nongame/projects/mlmp_state.html).

Web resources

Scientific method
www.sciencebuddies.org/mentoring/project_scientific_method.shtml
teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html
biology.clc.uc.edu/courses/bio104/SCI_meth.htm physics.ucr.edu/~wudka/Physics7/Notes/www/node6.html
www.biology4kids.com/files/studies_scimethod.html
www.dnr.state.mn.us/eco/nhnrp/research.html

Minnesota DNR research
www.dnr.state.mn.us/eco/nhnrp/research.html

Minnesota DNR Teacher Resources
www.mndnr.gov/education/teachers/index.html

Related articles

Related *Minnesota Conservation Volunteer* Young Naturalists articles are available online at www.mndnr.gov/volunteer/articles/index.html including:

November–December 2003
"Wired Life" (YN article with teachers guide)
http://www.dnr.state.mn.us/young_naturalists/wiredlife/index.html

July–August 2004
"About Those Bears"
http://www.dnr.state.mn.us/volunteer/julaug04/bears.html
"Eyes in the Skies"
http://www.dnr.state.mn.us/volunteer/julaug04/fncopilots.html

March–April 2004
"Get Neutrinos Here"
http://www.dnr.state.mn.us/volunteer/marapr04/fnneutrinos.html

January–February 2004
"The Far Reach of David Mech"
http://www.dnr.state.mn.us/volunteer/janfeb04/mech.html

March–April 2005
"Speaking for Wildlife"
http://www.dnr.state.mn.us/volunteer/marapr05/speaking.html

January–February 2008
"Counting Critters" (YN article with teachers guide)
http://www.dnr.state.mn.us/young_naturalists/counting_critters/index.html

July–August 2009
"Into the Inhospitable Peatland"
http://www.dnr.state.mn.us/volunteer/julaug09/peatlands.html

References

Hock, M.F., Deshler, D.D., and Schumaker, J.B. *Strategic Tutoring.* Lawrence, Kan.: Edge Enterprises, 2000.

Ogle, D.S. K-W-L *Group Instructional Strategy*. In A.S. Palincsar, D.S. Ogle, B.F. Jones, and E.G. Carr (Eds.), *Teaching Reading as Thinking: Teleconference Resource Guide*, pp.11–17. Alexandria, Va.: Association for Supervision and Curriculum Development, 1986.

Study Questions

Teachers guide for the Young Naturalists article "Let's Find Out" by Mary Hoff with illustrations by Stan Fellows. Published in the March–April 2010 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/scientific_method

Name _____ Period _____ Date _____

1. Scientists ask questions and search for answers through a process called the _____ _____.

2. How are scientists similar to sleuths? _____

_____

_____

_____

3. What question did Richard Baker want to answer in his study? _____

_____

4. Study the graph on page 51. What can you conclude about the loon in Minnesota? _____

_____

_____

5. Before large red pines near Badoura tree nursery were cut down, what was happening to red pine seedlings? _____

6. Why did Jana Albers decide to have the big trees cut down? _____

_____

7. What does the graph on page 55 tell you? _____

_____

_____

8. If you owned a home or cabin on a Minnesota lake, what could you learn from Paul Radomski's research? _____

_____

_____

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9. Match the term to its definition by drawing a line from one to the other.

Dependent variable	Fungus that kills red pine seedlings
Hypothesis	Possible to a question
Independent variable	Scientific test
Analyze	Environment where an organism lives
Diplodia	Variable measured in an experiment
Habitat	Living in or near water
Experiment	Variable that is controlled in an experiment
Aquatic	To closely examine

10. List the steps in the scientific method in the correct order:

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____

Challenge: If Richard Baker has discovered that loons were decreasing in numbers how could he have attempted to discover why? _____

_____

_____

_____

Study Questions Answer Key

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1. Scientists ask questions and search for answers through a process called the **scientific method**.

2. How are scientists similar to sleuths or treasure hunters? **Like detectives, scientists are good observers of the world around them. They gather information and pose questions to explain what they observe. They test their questions, examine the results for clues that might explain their observations and tell people about what they found**.

3. What question did Richard Baker want to answer in his study? **Was the population of loons in Minnesota decreasing?**

4. Study the graph on page 51. What can you conclude about the loon in Minnesota? **Answers may vary, but should include that while the population of loons has gone up and down from year to year in the counties studied, over the period of the study, the population does not appear to have changed**.

5. Before large red pines near Badoura tree nursery were cut down what was happening to red pine seedlings? **They were dying after they were transplanted.**

6. Why did Jana Albers decide to have the big trees cut down? **She discovered that the big trees were carriers of a deadly fungus, *Diplodia*.**

7. What does the graph on page 55 tell you? **After the big trees were cut down the percentage of seedlings that died after transplantation dropped from almost 90 percent to 0**.

8. If you owned a home or cabin on a Minnesota lake what could you learn from Paul Radomski's research? **Answers may vary, but should include that native vegetation should not be removed from the shoreline and the water. Doing so caused fish and wildlife populations to decrease.**

9. Match the term to its definition by drawing a line from one to the other.

Dependent variable (Variable measured in an experiment)

Hypothesis (Possible answer to a question)

Independent variable (Variable that is controlled in an experiment)

Analyze (To closely examine)

Diplodia (Fungus that kills red pine seedlings)

Habitat (Environment where an organism lives)

Aquatic (Living in or near water)

Experiment (Scientific test)

10. List the steps in the scientific method in the correct order:

1. **Observe**
2. **Ask a question**
3. **Gather background information**
4. **Propose a hypothesis**
5. **Design an experiment**
6. **Do the experiment**
7. **Analyze the results**
8. **Communicate the results**

Challenge: If Richard Baker has discovered that loons were decreasing in numbers how could he have attempted to discover why? **Answers may vary. Use the scientific method. For example, he may have observed that loons laid a good number of eggs, but few hatched. Why? He could make a hypothesis that something in the loons' diet was interfering with the chicks hatching. He could then collect specimens of fish the loons were eating and analyze for harmful chemicals. Other hypotheses could be made. The important aspect of this question is the student's connection of the scientific method with scientific inquiry.**

Minnesota Comprehensive Assessments Practice Items

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1. The scientific method is a strategy for
   A. Collecting information about the natural world.
   B. Answering questions about the natural world.
   C. Asking questions about the natural world.
   D. All of the above.

2. Paul Radomski chose lakes in three groups for his study,
   A. lakes with sandy, muddy, and rocky bottoms.
   B. lakes with shallow, deep, or variable depths.
   C. large, medium, and small lakes.
   D. lakes with few dwellings, some dwellings, and lots of dwellings.

3. Why do you think scientists plot their data on graphs? _____
   _____
   _____

4. Scientists cannot say with certainty that one thing causes another because
   A. two events happening at the same time may have nothing to do with each other.
   B. scientists do not care about causation.
   C. scientists do not have time to look for causes.
   D. experiments cost too much money.

5. What was Jana Albers looking for?
   A. Big red pines
   B. Red pine seedlings
   C. The reason seedlings were dying
   D. A new location for the tree nursery

Minnesota Comprehensive Assessments Answer Key

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1. The scientific method is a strategy for **D. All of the above.**
2. Paul Radomski chose lakes in three groups for his study, **D. lakes with few dwellings, some dwellings and lots of dwellings.**
3. Why do you think scientists plot their data on graphs? **Answers may vary, but should include that graphs are a means of analyzing and communicating results.**
4. Scientists cannot say with certainty that one thing causes another because **A. two events happening at the same time may have nothing to do with each other.**
5. What was Jana Albers looking for? **C. The reason seedlings were dying**

Vocabulary

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analyze	to closely examine or pick apart
aquatic	organism that lives in or near water
data	factual information gathered by scientists; often mathematical
dependent variable	that which is affected by the manipulation of the independent variable; the event that is studied and measured in an experiment
fungus	kingdom that includes yeasts, mold, and mushrooms
habitat	home environment of an organism
hypothesis	possible explanation or answer to a scientific question
independent variable	event that is controlled in an experiment
monitor	to check something regularly
sleuth	detective
species	group of plants or animals that are similar enough to reproduce with one another

Vocabulary Study Cards

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Cut along the horizontal lines, fold in the middle and tape or staple. Blanks are provided to allow you or your students to add new words or phrases.

To **analyze** is to	FOLD HERE	To **closely examine or pick apart** is to
An **aquatic** organism is one that	FOLD HERE	An organism that **lives in or near water** is
What are **data**?	FOLD HERE	Pieces of **factual information gathered by scientists, often mathematical,** are
What is a **dependent variable**?	FOLD HERE	**That which is affected by the manipulation of the independent variable; the event that is studied and measured in an experiment** is the

A **fungus** is	FOLD HERE	**A member of the kingdom that includes yeasts, mold, and mushrooms** is a
What is a **habitat**?	FOLD HERE	**The home environment of an organism** is its
What is a **hypothesis**?	FOLD HERE	**A possible explanation or answer to a scientific question** is a
An **independent variable** is the	FOLD HERE	An **event that is controlled in an experiment** is an
To **monitor** is to	FOLD HERE	To **check something regularly** is to

A **sleuth** is a

FOLD HERE

Another name for a **detective** is a

A **species** is a

FOLD HERE

A **group of plants or animals that are similar enough to reproduce with one another** is a

FOLD HERE

FOLD HERE

FOLD HERE