Young Naturalists

Teachers Guide

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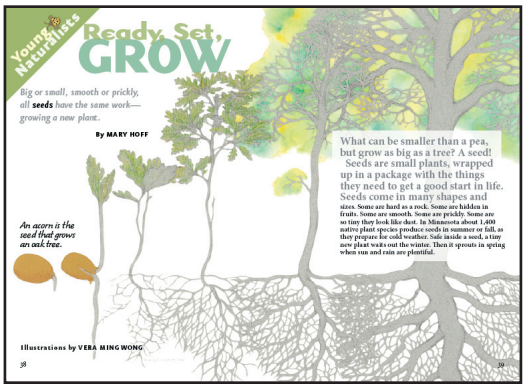
"Ready, Set, Grow" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Ready, Set, Grow" by Mary Hoff, with illustrations by Vera Ming Wong. Published in the September–October 2006 *Minnesota Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/seeds.



Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. Each guide contains a brief summary of the article, suggested independent reading levels, word counts, a materials list, estimates of preparation and instructional time, academic standards applications, preview strategies, a 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 to suit user needs. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html.

Summary

In "Ready, Set, Grow," the author introduces students to plant reproduction from seeds through the story of an acorn falling from an oak to the ground below, sprouting, and beginning to grow into a new oak tree. Topics include: flower and seed anatomy, seed dispersal, and conditions for germination.

Suggested reading levels: fourth through eighth grades

Total words: 1,321

Materials: Paper, poster board, pencils, pens, markers, print resources from your media center. Depending on which preview and extension activities you choose, you may also need additional supplies, including magnifying glasses, an unsalted peanut in the shell for each student, plastic or paper cups, potting soil, and seeds (beans are suggested). A grow light might be helpful, especially if natural light is scarce.

Preparation time: One to two hours, not including time for extension activities

Estimated instructional time: Two to three 50-minute class periods (not including extensions)

Minnesota Academic Standards applications: "Ready, Set, Grow" may be applied to the following Minnesota Department of Education Academic Standards:

Language Arts

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

Arts

Artistic Expression: Visual Arts

Science

Grade 4

IV. Life Science
- B. Diversity of Organisms

Grade 5

IV. Life Science
- E. Biological Populations Change Over Time

Grade 7

IV. Life Science
- A. Cells
- B. Diversity of Organisms
- D. Heredity
- E. Biological Populations Change Over Time
- F. Flow of Matter and Energy

Social Studies

Grades 4–8

V. Geography
- D. Interconnections: Students will use regions to analyze modern agriculture in Minnesota. Students will interpret regional variation in the relationships among soil, climate, plant and animal life, and landforms.

VI. Economics
- C. The Market Economy: Students will identify and compare and contrast various industries and the occupations related to them.

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

Preview

The preview for "Ready, Set, Grow" will depend on the standards addressed and/or the context within which the article is read. For example, if used as a part of a unit on plant growth, you may wish to read the article before planting seeds. Start by asking students to survey the article. Ask your students to examine the illustrations. Use the **KWL** strategy (Ogle, 1986) to find out what your students already know (**K**) about seeds and plant growth, what (**W**) they would like to learn, and eventually, what they learned (**L**) while reading the article and related materials and through participating in extension activities. 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. If you are reading the article as part of a unit on beginning life you might wish to examine a seed embryo (peanuts work well for this) under a magnifying glass. A number of Web sites listed under Web resources also suggest excellent preview activities.

Vocabulary preview

The italicized words in "Ready, Set, Grow" will challenge your students. Although italicized words are defined in the article, they are also included on reproducible study cards at the end of this guide. Study cards (Hock, Deshler, and Schumaker, 2000), can be applied to any subject area. 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. On one side of the card, in large letters, write a key word or phrase from the article 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. You may wish to preview the attached list as well as any other words based on knowledge of your students' needs. Connections to vocabulary in the article may be made during the **KWL** activity. These are key concepts and should be discussed before reading. If students are not familiar with some of the terms, include them in the **W** list. Unfamiliar terms may be added to the **W** list as the article is read. Eventually, they can be moved to the **L** list. You may write vocabulary from the article in green ink, while other ideas are written in black.

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, below). The study questions may be also used as a quiz. Note: Items 6, 8, 10, and 14 and the challenge require analytical thinking.

Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first—for example, items 1, 3, 7, 9, and 12. 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 some of the study questions, combined with vocabulary, as a quiz. Other assessment ideas (some might require additional resources): (1) Students may write an essay describing a specific seed's origin, dispersal, and germination. (2) Students may sketch a flower and/or seed anatomy. (3) Students may document a seed's germination and growth.

Extension activities

1. Students may plant and grow a variety of seeds in the classroom. Soil, water, nutrients, light, and temperature may be controlled to observe their effects on germination.
2. "Special Delivery" (see Related Articles below) is an excellent companion piece. Ask your students to compare and contrast eggs and seeds.
3. Take a field trip to a nursery, greenhouse, commercial seed operation or farm. If you are near a school of agriculture, you may wish to arrange a visit. A field trip may be particularly useful in meeting the economics standard for grades 4–8.
4. Explore the world of heirloom seeds through the Web sites listed below. Arrange a field trip to the Oliver Kelly Farm near Elk River for a firsthand look at heirloom gardens. A visit in September will allow students to observe heirloom produce, to learn how heirloom seeds are preserved, and to learn why heirloom seeds are important to biodiversity.
5. Genetic modification of seed is a controversial topic. Set up pro and con study groups and have a debate. What are the potential benefits and risks of genetic engineering?.
6. Invite Susan Anderson, food and life sciences education specialist, to your classroom. Susan, who works for the University of Minnesota and the Minnesota Department of Agriculture, travels throughout Minnesota providing workshops and demonstrations of best teaching practices (see Web site below).

Web resources

Seeds and classroom plant growing projects

www.education-world.com/a_tech/techlp/techlp035.shtml

www.iit.edu/~smile/bi9710.html

www.teachers.net/lessons/posts/1480.html
www.pfb.com/programs/ag-in-the-classroom/lesson3.htm
ed.fnal.gov/ntep/f98/projects/bnl/seed2mgb/index.htmlwww.enchantedlearning.com/subjects/plants/printouts.shtml

heirloom seeds
www.seedsavers.org/Aboutus.asp

genetically modified seeds
www.pbs.org/now/science/genedebate.html

Susan Anderson
www.mda.state.mn.us/MAITC/teacheredu.htm

Related *Minnesota Conservation Volunteer* articles (see www.dnr.state.mn.us/volunteer/articles) include:

May–June 2006
"Look Down in the Woods" (YN article with teachers guide)

March–April 2004
"Special Delivery" (YN article with teachers guide)

March–April 2003
"One Seed at a Time"

March–April 2002
"Plants that Eat Animals" (YN article)

January–February 2001
"GMOs: Friends or Foes"

May–June 2000
"Get Facts on Native Plants"

March–April 1999
"Tremendously Marvelous Trees" (YN article with teachers guide)

January–February 1996
"Busy Biomes" (YN article)

May–June 1981
"Seeds: Spring's Miracle of Renewal"

References

1. Hock, M.F., Deshler, D.D., and Schumaker, J.B. *Strategic Tutoring*. Lawrence, Kan.: Edge Enterprises, 2000.
2. 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

"Ready, Set, Grow," by Mary Hoff. Illustrations by Vera Ming Wong
Minnesota Conservation Volunteer, September–October 2006
www.dnr.state.mn.us/young_naturalists/seeds

Name _____ Period _____ Date _____

1. What spends the winter inside a seed? _____

_____

2. Of all the plant species that are native to Minnesota, how many produce seeds? _____

_____

3. Seeds begin as _____ .

4. A female flower is called a _____ flower.

5. A male flower is called a _____ flower.

6. Which part of the female flower may be compared to an egg? _____

_____

7. Describe how the two sperm in a pollen grain produce a fertile seed. _____

_____

_____

8. Most seeds contain a _____, _____ and _____.

9. Explain how a gymnosperm differs from an angiosperm. _____

_____

_____

10. Give two examples of each: monocot _____ dicot _____

_____ _____

11. Give examples of how wind, animals and people move seeds from one place to another. __

_____

_____

_____

12. When a seed sprouts it is called _____ .

Challenge: How does a berry help seed disperse? _____

_____

Study Questions Answer Key

"Ready, Set, Grow," by Mary Hoff. Illustrations by Vera Ming Wong
Minnesota Conservation Volunteer, September–October 2006
www.dnr.state.mn.us/young_naturalists/seeds

1. What spends the winter inside a seed? **A tiny new plant.**
2. Of all the plant species that are native to Minnesota, how many produce seeds? **1,400.**
3. Seeds begin as **flowers**.
4. A female flower is called a **pistillate** flower.
5. A male flower is called a **staminate** flower.
6. Which part of the female flower may be compared to an egg? **The ovule**.
7. Describe how the two sperm in a pollen grain produce a fertile seed. **After a pollen grain lands on the stigma it sends a long tube down into the style of the female flower to the ovary. Then it releases two sperm, which move down the tube. One sperm combines with the ovule to make an embryo, while the other sperm makes the endosperm, which will be food for the embryo.**
8. Most seeds contain a **root (radicle), stem (plumule)** and **leaflike parts (cotyledons).**
9. Explain how a gymnosperm differs from an angiosperm. **Gymnosperm plants make seeds in cones (pines, spruce, fir) or cups (yew). Angiosperms make seeds in ovaries.**
10. Give two examples of each: monocot **grass** **orchids** dicot **milkweed** **raspberries**

    (Other answers may be acceptable.)
11. Give examples of how wind, animals, and people move seeds from one place to another. **Answers may vary, but should include examples such as the following. Seeds with fluff, such as dandelions, are carried on the wind. Seeds catch on animal fur or people's clothing and are carried to new places. Seeds may be eaten by animals and deposited in droppings. People buy seeds and plant them in new places.**
12. When a seed sprouts, it is called **germination**.

Challenge: How does a berry help seed disperse? **The berry could be food for an animal, which could carry the seed in its intestines to a new place, where it would deposit the seed in its droppings.**

Minnesota Comprehensive Assessments Practice Items

"Ready, Set, Grow," by Mary Hoff. Illustrations by Vera Ming Wong
Minnesota Conservation Volunteer, September–October 2006
www.dnr.state.mn.us/young_naturalists/seeds

Name _____Period _____Date_____

1. What conditions does wild rice seed require to germinate?
   A. extreme heat
   B. darkness
   C. immersion in cold water
   D. none of the above

2. Dandelions are _____ to Minnesota, and can _____.
   A native, be used in salads
   B not native, beautify your lawn
   C. native, spread rapidly
   D. not native, spread rapidly

3. Catkins are another name for _____.
   A. female flowers
   B. seed coverings
   C. male flowers
   D. catnip

4. Energy is stored in seeds as _____, _____ and _____.
   A. starch, sugar, fat
   B. starch, sugar, fiber
   C. fiber, sugar, fat
   D. starch, fiber, fat

5. Cottonwoods depend on _____ to carry their seeds to new places.
   A. people
   B. animals
   C. the wind
   D. gravity

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www.dnr.state.mn.us/young_naturalists/seeds

1. What conditions does wild rice seed require to germinate? **C. immersion in cold water**
2. Dandelions are **D. not native** to Minnesota, and can **spread rapidly**.
3. Catkins are another name for **C. male flowers**.
4. Energy is stored in seeds as **A. starch, sugar, and fat**.
5. Cottonwoods depend on **C. the wind** to carry their seeds to new places.

Vocabulary

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angiosperm	a plant that forms seeds in flowers
catkins	long, furry clusters of leaves and staminate flowers, produced by willows, birches, alders, and poplars
cotyledon	the leaflike part of a seed
dicot	angiosperm that sprouts two leaves
endosperm	tissue that provides energy for the seed embryo
fertilize	to make a new plant by joining sperm and ovule
germinate	start to grow
gymnosperm	plant that forms seeds in cones or cups
inhibitor	chemical that prevents germination
monocot	angiosperm that sprouts a single leaf
ovary	lower part of pistil; produces ovules and ripens into fruit
ovule	female contribution to the seed
pistillate	containing the pistil (female reproductive part)

plumule	first shoot of a young plant
pollen	powdery substance that contains the sperm (male reproductive cells of flowering plants)
radicle	part of the plant embryo that forms the root
sperm	male reproductive cell
staminate	containing the male reproductive parts
stigma	part of female flower that receives the pollen
style	an extension of the ovary that supports the stigma

Vocabulary Study Cards

"Ready, Set, Grow," by Mary Hoff. Illustrations by Vera Ming Wong
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www.dnr.state.mn.us/young_naturalists/seeds

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.

A **pistillate flower** is	The **female flower** is called the
What is an **ovule?**	What is **the female contribution to the seed?**
What is a **catkin?**	What is **a cluster of staminate flowers produced by trees such as oak, birch, willow, alder, or poplar** called?

A **pollen grain** contains	A **powdery substance that contains sperm** is called
What is the **stigma?**	**The part of a female flower that receives pollen** is the
What is the **style?**	**A tube that holds up the stigma and connects the stigma to the ovary** is the
What is the **ovary?**	**A female plant part that produces ovules and ripens into fruit** is the

The
sperm
is

A plant's male reproductive cell
is called

To
fertilize
means to

To
unite the sperm and ovule
is to

What is the
endosperm?

What is
the part of the seed that supplies energy to the embryo after it germinates
called?

What is the
radicle?

A seed's first root
is called the

A
plumule
is

A seed's first shoot
is called the

What is a
cotyledon?

The
leaflike part of the seed
is the

What is a
gymnosperm?

A plant that produces seeds in cones or cups
is called a

What is an
angiosperm?

A plant that forms seeds in flowers
is called an

An example of a
monocot
is a

A
blade of grass
is an example of a

An example of a
dicot
is a

A
milkweed
is an example of a

What does
germinate
mean?

For a seed to
begin to grow
it must

An
inhibitor
is a

A chemical that prevents a seed from germinating
is called an