YOUNG NATURALISTS

TEACHERS GUIDE

TO "CLUES IN THE CLOUDS"

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, July–August 2018, www.mndnr.gov/mcvmagazine.

Minnesota Conservation Volunteer magazine tells stories that connect readers to wild things and wild places. Subjects include earth science, wildlife biology, botany, forestry, ecology, natural and cultural history, state parks, and outdoor life.

Education has been a priority for this magazine since its beginning in 1940. "One word—Education—sums up our objective," wrote the editors in the first issue. Thanks to the *MCV* Charbonneau Education Fund, every public library and school in Minnesota receives a subscription. Please tell other educators about this resource.

Every issue now features a Young Naturalists story and an online Teachers Guide. As an educator, you may download Young Naturalists stories and reproduce or modify the Teachers Guide. The student portion of the guide includes vocabulary cards, study questions, and other materials.

Readers' contributions keep *Minnesota Conservation Volunteer* alive. The magazine is entirely financially supported by its readers.

Find every issue online. Each story and issue is available in a searchable PDF format. Visit *www.mndnr.gov/mcvmagazine* and go to *Search MCV*.

Thank you for bringing Young Naturalists into your classroom!

"Clues in the Clouds"

Multidisciplinary classroom activities based on the nonfiction story in *Minnesota Conservation Volunteer*, July–August 2018, www.mndnr.gov/mcvmagazine.

Summary. Where do clouds come from? What can they tell us about the weather? "Clues in the Clouds" introduces Young Naturalists to the 10 main categories of clouds and what they tell us about the weather we're experiencing and that might be in our future. Note that this Young Naturalists feature is an especially good fit with Minnesota Academic Standards for 4th and 8th graders.

Suggested reading levels. Third through middle-school grades

Materials. KWL organizer; materials such as posterboard or audio- or video-recording devices for presentations; websites and YouTube videos mentioned in Web Resources; two-liter bottle and matches (optional); and other print and online resources your media specialist may provide.

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

Estimated instruction time. One or two 50-minute class periods (not including extensions)

Minnesota academic standards applications. "Clues in the Clouds" may be applied to the following Minnesota Department of Education standards:

Language Arts Reading Benchmarks Informational Text 3–8
Key Ideas and Details, Craft and Structure, Integration of Knowledge and Ideas, Range of Reading and Level of Text Complexity

Writing Benchmarks 3–8 Text Types and Purposes, Writing Process, Research to Build and Present Knowledge, Range of Writing

Reading Benchmarks: Literacy in Science and Technical Subjects 6–8

Key Ideas and Details, Craft and Structure, Integration of Knowledge and Ideas, Range of Reading and Level of Text Complexity

Writing Benchmarks: Literacy in History/Social Studies, Science, and Technical Subjects 6–8

Text Types and Purposes, Writing Process: Production and Distribution of Writing, Research to Build and Present Knowledge, Range of Writing

Science 3, 4, 5, 6, and 8

The Nature of Science and Engineering
3.1.3.2.3; 3.1.3.2.1
Physical Science
4.2.1.2.1; 4.2.1.2.2; 4.3.2.3.1; 6.2.1.2.3
Life Science
5.4.4.1.1
Earth and Space Science
4.3.2.3.1; 5.3.4.1.3; 8.3.1.1.1; 8.3.1.2.1; 8.3.2.1.3; 8.3.2.2.1; 8.3.2.3.2; 8.3.4.1.2

Arts K-12

1. Artistic Foundations: Visual Arts; Music
2. Artistic Process: Create or Make: Visual Arts
3. Artistic Process: Perform or Present: Visual Arts; Music
4. Artistic Process: Respond or Critique: Visual Arts; Music

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

Preview. (1) Several days before you begin this lesson, ask students to look at the sky every day on their way to and from school. What kinds of clouds do they see? How are they the same as, or different from, ones they've already observed? If appropriate for your students, have them keep a "cloud log" with a written description and/or sketch of their observations. (2) Use a KWL activity to find out what your students already know (K) about clouds, and what they would like to learn. Divide the class into small groups to brainstorm their ideas. Give each student a copy of the organizer (see www.teachnology.com/web_tools/graphic_org/kwl.) and encourage each to make notes during the group discussion. Ask what students would like to learn, or what questions they have, about clouds (W). Record their questions on poster board for reference. As you read and discuss the article you will begin to compile the (L) lists, or what they learn while reading the article and related materials and participating in extension activities. KWL gives you the opportunity to introduce interdisciplinary connections you will make during extension activities.

Vocabulary preview. You can find a copy-ready vocabulary list at the end of this guide. Feel free to modify it to fit your needs. Share the words with your students and invite them to guess what the words mean. Tell them you will be reading a story that will help them understand these words so they can use them in the future!

You might wish to use the study cards (adapted from *Strategic Tutoring*) found at the end of the Study Questions for this Young Naturalists feature. On one half of the card, in large letters, is a key vocabulary word or phrase with smaller letters framing the word or phrase in a question or statement. On the other half is the answer to the question or the rest of the statement. Cut along the horizontal line, fold in the middle, and tape or staple, then use like flash cards. We've included a few blanks so you or your students can add new words or phrases if you'd like.

Study questions overview. Preview the study questions with your class before you read the article. Then read the story aloud. Complete the study questions in class, in small groups, or as an independent activity, or use them as a quiz.

Adaptations. Read aloud to special needs students. Abbreviate the study questions or focus on items appropriate for the students. Adapt or provide assistance with extension activities as circumstances allow.

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 describe what they learned about clouds. See the "learned" list from your KWL activity. (2) Have students write multiple-choice, true-false, or short-answer questions based on the article. Select the best items for a class quiz. (3) Posters, podcasts, videos and other presentations are an excellent strategy for allowing students to demonstrate what they have learned.

Extension Activities. Extensions are intended for individual students, small groups, or your entire class. Young Naturalists articles provide teachers many opportunities to make connections to related topics, to allow students to follow particular interests, or to focus on specific academic standards.

1. Invite a local meteorologist to talk to your class about clouds and weather. Ask the person to include in his or her presentation the story of how he or she became a meteorologist.
2. Observe famous paintings and talk about the different ways artists incorporate clouds into their work. How do clouds affect how we feel about the scenes depicted? Do different types of clouds evoke different emotions? Connections: Clouds from New York's Metropolitan Museum of Art and Windows to the Universe can help you get started. If one of your students has a parent who is an artist, invite him or her in to demonstrate techniques for drawing or painting different kinds of clouds.

3. Explore the relationship between clouds and climate change. Are increasing CO2 levels affecting where and how clouds form? If so, how? How might we artificially manipulate clouds to help reduce the increase in temperature due to CO2?
4. Make a cloud in a bottle. Weather WizKids offers a simple experiment using a 2-liter plastic bottle, along with a brief explanation of what's happening and why.
5. Research weather folklore sayings that suggest ways to predict weather from clouds (see Web Resources for some suggested links). What kinds of clouds do they refer to? How do the predictions fit with what science tells us about the connections between clouds and weather?
6. Experienced anglers have lots to say about fishing and cloud cover. Have students interview relatives and friends to get their thoughts on what clouds can tell us about when and how to fish for various kinds of fish, then compile what they learn into a guide book of your own.
7. Research the etymology of cloud names. See Web Resources below for some suggested websites.
8. Have students photograph various kinds of clouds and identify them.

Web Resources

General Teacher and Student Resources

Minnesota DNR Teachers' Resources
DNR Kids Page

Related MCV Article

Young Naturalists: Hey How's the Weather?

Clouds

Weather WizKids: Clouds (includes lesson plans)
Predicting the Weather With Clouds

Cloud Folklore

Weather Proverbs and Prognostics: Rain and Clouds
Weather Lore

Cloud Names

How Are Clouds Named? -
World Meteorological Association International Cloud Atlas -

Other Related Articles and Resources

NASA Cloud Identification Chart -
All About Clouds for Kids: Types and Names of Clouds (video) -

All *Minnesota Conservation Volunteer* articles are available online in searchable PDF.

Study questions answer key

1. What three ingredients are needed to make a cloud? **Water vapor, dust particles, cool air**
2. When water condenses, it
a. turns from a gas into a liquid
b. turns from a liquid into a gas
c. turns from a liquid into a solid
d. turns from a solid into a liquid
3. What happens when two air masses run into each other? **One slides over the top of the other. As it rises higher into the air, it cools off, forming clouds.**
4. True or false: Air higher in the sky is warmer than air closer to Earth. **False: the farther from Earth's surface, the colder the air.**
5. Puffy clouds form when _____ causes air to move skyward. Stringy clouds form when _____ causes air to move skyward. **the sun's warmth; wind**
6. Earth's surface covers 197 million square miles. About how many square miles do clouds cover? How many square kilometers? **148 million; 383 million**
7. What three factors determine which category a cloud falls into? **How high in the sky it is, the shape it takes, whether it produces precipitation.**
8. Name two ways in which nimbostratus and cirrus clouds are similar and two ways in which they differ. **Answers may vary. Similar: both are made of water, both are in the sky, etc. Differ: nimbostratus are low in the sky and cirrus are high; nimbostratus cover the sky while cirrus allow blue sky to show through; nimbostratus are made of liquid water while cirrus are usually made of ice crystals; nimbostratus create rain while cirrus signal a possible change in weather.**
9. True or false: Cumulus clouds are more common in winter and stratus clouds are more common in summer. **False—the opposite is true.**
10. When you "see your breath" in winter, what are you really seeing? **Clouds that form when the cold air causes the warm water vapor in your breath to condense.**
11. Name three cloud types that tell us rain or snow could be on the way. **Answers may vary. Choices include nimbostratus, stratocumulus, cumulonimbus, stratus, altostratus, altocumulus.**
12. Match the cloud type with the fact about it:

nimbostratus	**dark gray clouds that cover the entire sky**
cumulonimbus	**clouds associated with thunderstorms**
cirrus	**featherlike clouds high in the sky**
cirrocumulus	**clouds that foretell cold weather with no snow**

13. Why do cloudless nights tend to be cooler than cloudy nights? **Clouds trap the Earth's heat close to the surface, so less escapes into the upper atmosphere when the sun isn't around to warm things up.**

Bonus: What are some possible reasons that cities have more clouds than rural areas? **There are many possibilities. One is that the pollution in cities helps clouds start. Another is that tall buildings cause air to rise and form clouds. Another is that the pavement in cities cause them to warm up, and clouds form when the warm air rises. Other ideas welcome!**

Minnesota comprehensive assessments practice items.

1. What do clouds with "cumul" in their names have in common? **They are puffy.**
2. What do clouds with "nimb" in their names have in common? **They tend to bring rain.**
3. What do clouds with "strat" in their names have in common? **They form sheets or layers.**
4. What two kinds of clouds are most likely to create a halo effect around the sun or moon? **cirrus and cirrostratus**
5. If you are looking forward to a fun day outdoors, which kind of cloud would you most like to wake up to, and why? **Answers may vary. If the student would like a day without precipitation, best answers would be cumulus or cirrus. If the students would like rain or snow, best answers would be nimbostratus, stratocumulus, cumulonimbus, stratus, or altostratus.**

Vocabulary list

dense containing a lot of matter for the amount of space
foreground front
frail easily damaged or broken
halo a ring of light
phrase part of a sentence
precipitation rain, snow, sleet, etc.
suspended held without touching a surface in air or water
wispy made of delicate, stringlike shapes