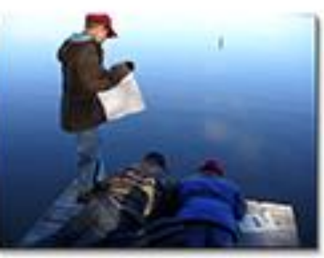
Lesson Plans



MOSS

McCALL OUTDOOR SCIENCE SCHOOL

University of Idaho
College of Natural Resources

Title: How to be a Citizen Scientist
Grade Level: 5th - 8th grade

Topic:	Become a scientist in your classroom!
Background:	This lesson will introduce students to the scientific process and teach them that they can do science. They will go through the steps of the scientific process and create mini experiments in the classroom. They will learn how they can become citizen scientists.
Next Generation Standards:	**Teaching Standard A** Teachers of science plan an inquiry-based science program for their students. In doing this, teachers • Develop a framework of yearlong and short-term goals for students. • Select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students. • Select teaching and assessment strategies that support the development of student understanding and nurture a community of science learners. • Work together as colleagues within and across disciplines and grade levels. **Teaching Standard E** Teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning. In doing this, teachers • Display and demand respect for the diverse ideas, skills, and experiences of all students. • Enable students to have a significant voice in decisions about the content and context of their work and require students to take responsibility for the learning of all members of the community. • Nurture collaboration among students. • Structure and facilitate ongoing formal and informal discussion based on a shared understanding of rules of scientific discourse. • Model and emphasize the skills, attitudes, and values of scientific inquiry. • TABLE 6.1. SCIENCE AS INQUIRY STANDARDS

LEVELS K-4	LEVELS 5-8	LEVELS 9-12
Abilities necessary to	Abilities necessary to	Abilities necessary to

	do scientific inquiry Understanding about scientific inquiry · do scientific inquiry Understanding about scientific inquiry · do scientific inquiry Understanding about scientific inquiry
Goals:	Students will explore the concept of being a citizen scientist and conduct an experiment using the Scientific Method. Essential Questions: 1. What is a Citizen Scientist? 2. How can I conduct scientific experiments?
Objectives:	• Students will define the term Citizen Scientist. • Students will conduct an investigation based on the Scientific Method. • Students will explain how the Scientific Method can be used in everyday life.
Materials:	Students will need notebooks and pencils.
Set up:	None
Classroom Time:	1-2 hours, depending how in depth the teacher wants the students to work on their mini experiments.

Introduction (Engage):	**Ask students: "**First of all, what is a citizen scientist and who can be one?" **Explain**: Anyone can be a citizen scientist, regardless of scientific background, age, occupation or location. A citizen scientist is anyone who collects and shares scientific data. **Sandwich Skit:** Illustrates the scientific process to the students with a humorous example they can relate to. Requires two "actors", either two students can read the script to their peers, or a teacher and teacher's aid can perform it. The script is at the end of this lesson plan. How to be a citizen scientist: Step 1: Embrace Scientific Inquiry **Explain**: Scientific inquiry is the process of using observations and questions to understand the world around us. We all have the key observation tools to start us off with scientific inquiry- our five senses! Using our senses of touch, sound, sight, smell, and

	even sometimes taste, we can observe the world around us. By asking questions like "I wonder why…?" or "I wonder how…?" about those observations, we can begin the process of inquiry. This throws us into the scientific method, the adventure of seeking out answers and new questions to our scientific inquiries. Scientists use this process to carry out research to contribute new discoveries to the scientific community and to benefit the public with scientific developments! The Scientific Method is the process of asking a question, creating a hypothesis and testing that hypothesis through an experiment. With the data from the experiment, you can analyze your results, conclude whether or not your data supports your hypothesis, and finally reflect by asking new questions, sharing your results with fellow citizen scientists, and thinking about how you may do your experiment differently next time. **Student Activity:** Give the students fifteen minutes to make new observations of their surroundings using their five senses. This can take place in the classroom or outdoors. <u>Step 2: Ask a question:</u> **Explain**: So you've alerted your senses, and you're making observations of the world around you. But you're not satisfied, you are curious and you want to know more. Now it's time to ask a question. What makes a good scientific question? A good scientific question should ask something interesting and worthwhile and it should be a question that you have the time and resources to answer. You should be able to answer yes to all of the following questions about your question to know if it is a good question. ⑥ Is your question a question that can be answered through a SAFE experiment (i.e. no out of control explosions, forest fires, cliff jumping, etc!)? ⑥ Do you have the tools necessary to test your question? ⑥ Do you have enough time to test your experiment?

	⑥ Is your question specific? A question like, "What affects the water quality of streams?" is very vague. Narrow it down. Maybe you could ask, "How does the temperature affect the dissolved oxygen levels in my stream? ⑥ Are you excited about your question? ⑥ Is it a question that has never been asked before? **Student Activity:** Ask the students to come up with scientific questions based on their observations. The questions can be written on the board and can be examined together. "This is a great question but do we have the scientific tools to test this?" "What tools can we use to test this question?" "Do we already know the answer to this question?" "Is this question one that can produce an answer?" Remind the students that there is no such thing as a bad question. Make sure to explain to them why their question may not be suited for scientific inquiry while remaining supportive of their questioning. Encourage the students to come up with questions that can produce a short experiment to be done in the current class period. For example, students can test three different type of balls, tennis, bouncy & baseball, to see which bounces the highest when dropped from a set height. Not all science needs fancy tools; it's the process, not the equipment! <u>Step 3: Create a Hypothesis</u> **Explain**: A hypothesis is an informed answer to your question. Using background knowledge come up with an educated guess to answer your question. Fill in these blanks to start brainstorming about your hypothesis: "I think ________________________ because ____________________________." **Student Activity:** Choose several questions from the list on the board and have the students create hypotheses for them. Make sure the students include a "because" in their hypothesis. <u>Step 4: Design Your Experiment</u> **Explain**: Now this is the fun part! The key to

	designing your experiment is to ensure that you have just one variable that you are testing. For example, if your question "Which type of tree lives in moister soil, Ponderosa Pine or Douglas Fir?", you should attempt to take the soil moisture in the same place beneath every tree so that the aspect (the direction of your measurement and the sun's placement) does not affect your results. Try to isolate whichever variable it is that you're testing so that everything else is constant. Outdoor scientists definitely endure challenges when designing experiments. Unlike indoor labs, it is difficult to isolate variables due to the variability of conditions outside. It may be windy or raining, or maybe your tools aren't perfect. Lots of factors may influence your results, so be as creative and resourceful as you can to really try to make your experiment as well planned out at possible. Remember to write out the steps to your procedure and keep a material list. The goal of your experimental design is that if other citizen scientists want to ask the same question as you in a different location, or if they want to repeat your experiment in the same place, they should be able to follow your steps and recreate your project. **Student Activity:** Using your list of questions and hypotheses, pair the students up and have them design ways to test their hypotheses. You may have to provide some background information if they don't know enough about their topic.
Activity (Explore):	<u>Step 5: Collect Data</u> **Explain**: Get out there and do it! Now that you have thought through your procedure, it's time to go do it! Before you head out, create an organized data table in your field notebook to record your results. Remember to label the data, time, and location you collected your data. You can also jot down observations of factors that you believe may influence your data, such as the weather, or maybe a tool that doesn't seem to be working perfectly. Remember, science never happened unless you wrote it down. All your work is meaningless unless you record your data in a way that you can understand it when you get out of the field and back to the classroom. **Student Activity:** This is the fun part! Give the

	students time to conduct their mini experiments. Make sure they have notebooks and pencils to record their data.
Explanation	<u>Step 6: Analyze Data</u> **Explain**: Use these tools to analyze your data. Make charts, graphs, pie charts, drawings, skits, photos, etc. **Student Activity:** Have the students organize their data in charts or graphs. This step may require some basic math like averaging their results. <u>Step 7: Draw Conclusions</u> **Explain**: Once you have looked at your data, you should be able to draw a conclusion. Did your results support your hypothesis? Why or why not? Your scientific experiment is equally valuable if your results support or do not support your hypothesis. In your conclusion, you can explain what your results show, and why you think your project is important. **Students Activity:** What does the data the students have come up with mean? Have them pair up with their experiment partners and discuss the meaning of their results. Was their hypothesis supported?
Elaboration:	<u>Step 8: Reflect and Share!</u> **Explain**: <u>Experimental error</u>: What factors may have affected your results? Do you think you took enough measurements? This is where your observations might be important. Don't be afraid to admit that your experiment is not perfect! Make recommendations as to how you could do it differently next time. <u>Why is this important?</u> Think about what you learned from your experiment. Why do you think people should care? What types of people might care about your results? Think about why maybe land managers, fisherman, rafters, dam operators, fish, or even macro invertebrates might care about your results. **Student Activity:** Have students write a reflection on the conducted experiment. Below are some questions you may want to have students include in the reflection. <u>Further questions?</u> What new questions do you

	have? Could another citizen scientist carry on with your research by asking a new question that would make the research more meaningful? Are there any new relationships that you are curious about that you did not think about before?
Evaluation:	**Student Activity:** Have the students brainstorm further research questions that may help them answer their original question, or new questions that came up in the course of the experiment. If you plan to have your students to contribute to a citizen science project (see additional resources below) you can introduce the project here.

Additional resources:
http://www.scistarter.com/
The Network for Citizen Science is a great resource for getting connected to informal and formal science research projects around the globe. The site will allow you and your students to actively contribute to real research, and put into practice being a Citizen Scientist.
http://science-edu.larc.nasa.gov/SCOOL/index.php
The S'COOL project is a part of NASA and involves students (ages 5-20+) in real science. making and reporting observations of clouds to assist in the validation of NASA's CERES satellite instruments.