



iQsmartparent
Support Our Schools Special Edition:

Citizen Science

wqed.org/iqsp/sos-special-episode/

Lesson Plan

to accompany a 30-minute program

Overview & Rationale

This cross-curricular collection of **lesson plans** introduces 5th and 6th graders to the concept of **Citizen Science**. Citizen science is the practice of public participation and collaboration in scientific research to increase scientific knowledge. Through citizen science, people share and contribute to data monitoring and collection programs.

After screening the companion program *iQsmartparent-Support Our Schools Special Edition: Citizen Science*, students will hone vital critical thinking skills and apply principles of STEAM with the help of detailed lecture notes, large-group discussion guides, small-group activities, and a research paper assignment. In addition, the culminating activity in this unit requires students to **choose and participate in a Citizen Science project**; create a journal to describe activities performed; and create a visual aid to explain what the project is and how data gathered by citizen scientists is being used by scientists to draw conclusions based on evidence.

These lessons employ both the **scientific inquiry process** and the **scientific method**; and they show students ways in which curiosity about their own communities can contribute to advances in scientific knowledge. The ultimate goal of this lesson is to help students build confidence, curiosity, creativity, and collaboration skills to identify and contribute to scientific investigation.

Note that material in this lesson plan includes options and guidelines for both synchronous and asynchronous classroom use; and, rubrics are provided for all major assignments.

Grade Level of Target Group: 5th & 6th graders.

Total Time: 6 x 50-minute class periods, plus out-of-class writing activities/assessments with flexible turnaround times. This plan also includes optional activities for maximum flexibility, and could take an additional 4 – 8 days to complete and present, depending on class size.

Standards

* Content in this collection of lesson plans aligns with:

Next Generation Science Standards - <https://www.nextgenscience.org/search-standards>

- Asking questions
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Common Core – Standards for Mathematical Practice

[CCSS.Math.Practice.MP1](#)

[CCSS.Math.Practice.MP2](#)

[CCSS.Math.Practice.MP3](#)

[CCSS.Math.Practice.MP5](#)

[CCSS.Math.Practice.MP6](#)

Common Core - English Language Arts Anchor Standards

[CCSS.ELA-Literacy.CCRA.R.1](#)

[CCSS.ELA-Literacy.CCRA.R.2](#)

[CCSS.ELA-LITERACY.CCRA.L.5](#)

[CCSS.ELA-Literacy.CCRA.R.7](#)

Goals For Understanding // Essential Questions

- How do scientists conduct research?
- What is **Citizen Science**, and, how does it contribute to advancing scientific knowledge?
- What is the history and evolution of citizen science?
- What is the value of having a large number of citizen scientists collect data from many different locations?
- What is the value of conducting long-term research studies?
- What resources and research methods can be used to identify and explore past and current citizen science projects?
- What is the **scientific inquiry process**; and, how does it differ from the **scientific method**?
 - What **scientific practices** are used to collect data?
 - What **mathematical practices** are used to analyze data?
 - Which **English Language Arts** skills are used to communicate processes and findings throughout the process of scientific investigation?

- Which **Art & Design** skills can be used to visualize and accurately communicate data (e.g. pie charts, bar graphics, photo comparisons, etc.)?
- How can young people find, evaluate, and participate in ongoing research projects as citizen scientists?

By the end of these lessons students will be able to:

- Understand and explain how researchers use data in large quantities from different locations in order to accurately answer questions; and the role that citizen science plays in helping to gather that data to contribute to the process of advancing scientific knowledge.
- Conduct research, analyze information, and make inferences by comparing and contrasting a variety of texts.
- Observe their surroundings and identify questions that can be explored through the scientific inquiry process.
- Collaborate with peers to plan and execute research on a citizen science project.
- Participate in the scientific inquiry process and the scientific method by conducting research and collecting data as part of a current citizen science project.
- Apply mathematical practices to quantify and comprehend data in order to support their claims through evidence.
- Demonstrate English Language Arts skills to clearly and accurately communicate ideas; and employ Art & Design skills to visualize data.
- Draw conclusions and communicate project results to a wider audience through the creation of a PowerPoint (or similar) presentation; and, determine which tools will best help to visualize data results.

Lesson 1 – Introduction & Lecture

SCREENING (during synchronous class session):

This unit begins with students screening the companion program *iQsmartparent-Support Our Schools Special Edition: Citizen Science*.
Accessible at wqed.org/iqsp/sos-special-episode/

Lecture guide - (synchronous) OR assigned reading (distance-learning/asynchronous)

We just saw a number of young people learning about science *while actually assisting scientists conduct research!* In this unit, we will talk about how everyday people can help the scientific community tackle some of its biggest projects. Let's begin by discussing this question: HOW do scientists conduct research?

Scientists do many things to conduct research, including:

- ask questions
- make observations
- conduct experiments
- gather and analyze data

Scientists need *a lot* of data to test hypotheses and draw conclusions. But it takes time to gather all of that data. It may also require travel to different places around a city or the country – or even to different places around the world. That's a lot of work!

Scientists may also need to gather data to observe changes *over long periods of time*. It could take weeks, months, years, or even decades. This is called **longitudinal research**.

The world's longest running longitudinal study lasted over 80 years! It was called the Terman Study of the Gifted and it investigated how highly intelligent children developed into adulthood. That study began in 1921 and data was still being compiled in the 2000s!¹

So, collecting data for a research study often takes time and effort.

But what if scientists had a team of helpers to assist them with their research? It could mean they are able to collect *more* data, and do it *even faster* than if they were working alone. It could mean the scientists wouldn't have to travel so often to different locations, which helps them save time *and* money. It could also mean that we **speed up the pace of scientific discoveries** that benefit everyone!

Key concept of this unit: *Like so many things in society, people can accomplish tasks more quickly and more easily when they work together. In the world of science, that kind of collaboration and cooperation happens through something called **Citizen Science**.*

¹ Terman, L. "The Genetic Studies of Genius." *Journal of the American Medical Association*. 1931;96(7):554. Retrieved 20 Oct 2020.
<https://jamanetwork.com/journals/jama/article-abstract/249365>

What is Citizen Science?

Citizen science is the practice of public participation and collaboration in scientific research. Through citizen science, everyday people from all walks of life share and contribute to data monitoring and collection programs, helping to increase scientific knowledge. Usually this involves people working with or being led by a team of scientists, engineers, or other researchers with varied backgrounds and expertise, to collect and report data. **Everyday people who help researchers are called Citizen Scientists.**

You may be familiar with the term “**crowdsourcing**,” which is used often in reference to large groups of people contributing information to a project, typically using the Internet, social media, and smartphone apps. Think of **citizen science as a type of crowdsourcing.**

Citizen scientists have varying levels of expertise and can perform many tasks to help with observations and data collection. For example, they might make observations about bird migration and report their data on a website. Perhaps they help scientists sort through and classify photos or other data. They might collect water samples in their neighborhood and give them to scientists for analysis. They may even play video games at home to help scientists study hand/eye coordination!

History is filled with exciting and inspiring stories of scientists who engaged the public in their research. Of course, modern technology has made it even easier and more accessible than ever for people around the globe to make contributions as citizen scientists. At this very moment, there are over **3,000** active Citizen Science projects going on around the world², meaning it isn't hard to find a project that matches up with your own personal interests!

Let's think about citizen science in terms of something we *all* experience: *Weather!* “Weather” covers a lot of things, from the threats of climate change, to precipitation records, to observations about cloud formations.

As we saw in the *iQsmartparent television program we watched at the beginning of this lesson*, weather was of particular interest to Thomas Jefferson. He was the first person to envision a large network of *weather observers*. We can *all* observe clouds, so let's use that as a simple example of citizen science.

There is a citizen science project called the **GLOBE Observer**, and it asks everyday people – *like you* – to observe and report on clouds you see in your region. *Your* data helps scientists at the National Aeronautics and Space Administration (also known as NASA) study how atmospheric moisture affects our weather and climate. That means data that *you* collect can help NASA safely launch rockets and satellites into space!

² *SciStarter*, scistarter.org/.

Large group activity: The instructor will lead the class in an exploration of these websites:

The project is organized at this website:

GLOBE Observer website: <https://observer.globe.gov/do-globe-observer/clouds>

You can view data collected by Citizen Scientists here:

GLOBE Visualization System showing recorded data: <https://vis.globe.gov/clouds>

Reflection/Conclusion: As you can see, individual efforts can add up to a tremendous amount of data for scientists to study, and that can lead to new discoveries that help all of us!

We will spend time in this unit learning about – and even *participating in* – citizen science so we can not only *learn* about science, but also contribute to new scientific knowledge.

Who knows. . . perhaps *you* will be part of a scientific discovery that future generations of students will be learning about in *their* classrooms one day!

Lesson 2 – Lecture & Small Peer Team Activities

The History of Citizen Science

Citizen science is exciting... but it is *not* a new concept. In fact, this kind of scientific collaboration has been happening for centuries!

Example A: Records show American Colonialists as far back as the mid-1600s tracked weather patterns.³ Let's do an even deeper exploration of Thomas Jefferson and his network of weather observers.⁴ Jefferson recruited volunteers in six states (Virginia, Massachusetts, Pennsylvania, Connecticut, New York, and North Carolina), and that effort evolved into the National Weather Service we use today, with more than 20,000 total observers and observation stations!

Activity for a synchronous class: At this point in the lesson, the instructor may choose to briefly explore the website of the National Weather Service with students, to underscore the evolution of Jefferson's network of weather observers.

www.weather.gov/

Activity for an asynchronous or synchronous class: The instructor may choose to ask students to explore the website of the National Weather Service (NWS) and create a data chart that compares NWS *predicted* temperatures to NWS *actual recorded* temperatures over the span of 5 days. Students/Peer Teams will present their findings in oral presentations *or* on a Discussion Board*⁵.

Example B: John Audubon was another promoter of citizen science. He was a famous American ornithologist (person who studies birds), and when he was just a teenager, he began tracking the migration habits of birds. He formalized his efforts as he got older and today there are Audubon society chapters around the globe, with citizen scientists helping to track the changes in bird populations worldwide.⁶

Activity for a synchronous class: At this point in the lesson, the instructor may choose to briefly explore the website of the National Audubon Society with students, to underscore the evolution of John Audubon's work. www.audubon.org/

Optional activity for an asynchronous or synchronous class:

Part I: The instructor may choose to ask students to explore the website explore the website of the National Audubon Society, to underscore the evolution of John Audubon's work. www.audubon.org/

³ "History of Citizen Science." *CosmoQuest*, cosmoquest.org/x/about-cosmoquest/history-of-citizen-science/.

⁴ US Department of Commerce, NOAA. "Cooperative Observers." *National Weather Service*, NOAA's National Weather Service, 11 Dec. 2012, www.weather.gov/bgm/cooperative.

⁵ *See Discussion Board Rubric at the end of this document

⁶ "History of Citizen Science."

Part II: The instructor may choose to ask students (or Small Peer Teams) to explore the Audubon Society Guide to North American Birds www.audubon.org/bird-guide Students/Peer teams will use the guide to identify 3 (three) birds they observed in their community; and, they will present their findings in oral presentations *or* on a Discussion Board*⁷.

Example C: Another example of someone at the forefront of Citizen Science is Mary Anning, who began collecting fossils and skeletons as a teenager around her home in Devon, England at the beginning of the 19th century. Although she never received a formal education, she was regarded as one of England's leading experts on fossils, and in her lifetime she made major advances in our understanding of dinosaurs.⁸

Optional activity for a synchronous or asynchronous class: The instructor may choose to briefly explore the website of the Natural History Museum in London, England; and explore resources showing fossil collections discovered by Mary Anning. www.nhm.ac.uk/discover/mary-anning-unsung-hero.html

Optional activity for a synchronous or asynchronous class:

Part I: The instructor may choose to ask students (or Small Peer Teams) to explore the Paleobiology Database <https://paleobiodb.org/#/> and its interactive map plotting the location of every fossil ever found. <https://paleobiodb.org/navigator/>

Part II: Students/Peer teams will use the interactive map to identify 3 (three) fossils that have been discovered in their region (*or* close to it). Students/Peer Teams will present their findings in oral presentations *or* on a Discussion Board*⁹.

Now that you understand the value of Citizen Science, we will continue to study it in our upcoming classes, and *you* will even have the chance to participate in a citizen science project!

(synchronous) Please complete the reading & screening assignments for homework and be prepared to discuss them in the next class period.

(asynchronous) Please complete the reading & screening assignments for homework and be prepared to apply the concepts in your upcoming activities.

(asynchronous) HOMEWORK OPTION –DISCUSSION BOARD*¹⁰:

⁷ *See Discussion Board Rubric at the end of this document

⁸ “History of Citizen Science.”

⁹ *See Discussion Board Rubric at the end of this document

¹⁰ *See Discussion Board Rubric at the end of this document

ANSWER THE FOLLOWING QUESTION: **Question:** According to the assigned homework reading, name some reasons why young people make good citizen scientists.

LESSON 2 - HOMEWORK

READ: Science News for Students – *Kids make great citizen scientists*

www.sciencenewsforstudents.org/article/kids-make-great-citizen-scientists

WATCH: SciShow – *The Amazing Power of Citizen Science* (10-minute long video)

www.youtube.com/watch?v=SZwJzB-yMrU

Lesson 3 – Lecture

Lecture guide - (synchronous) OR assigned reading (distance-learning/asynchronous)

We are continuing our study of **citizen science**, and we will begin with a review of the assigned readings.

(synchronous) REVIEW of ASSIGNED HOMEWORK READINGS:

Question: According to the assigned homework reading, name some reasons why young people make good citizen scientists.

- Young people tend to be curious
- Young people are good at following precise directions
- Schools are a convenient place for researchers to recruit large groups of helpers.
- Young people can relate this real-world experience to concepts that they're learning in science class.
- Young people offer new ways of looking at an issue.

As we saw in the *iQsmartparent television program we watched at the beginning of this unit*, young people displayed a variety of skills to help study the insect population in a stream; and, to take water samples from a freshwater stream. Those young people worked well together in a team; they used their observation and writing skills to record data; they used their art & design skills to draw pictures of the insects they found; and, they used critical thinking skills to draw conclusions based on the data they collected.

Those are *all* good skills for a scientist!

Question: What qualities and skills do *you*, personally, have that you think might make you be a good citizen scientist?

For example:

- I am reliable so I can be trusted to report data regularly.
- I am good at using technology, such as the Internet and smartphone apps.
- I would feel good about helping to advance scientific knowledge.

Some of the qualities that make you good *students* also make you good citizen scientists:

- Being curious about the world around you.
- Being observant.
- Using logic to answer questions.
- Using what you already know to learn more about things that you don't know.
- Sharing what you've learned with others.

Those are all requirements for following the **Scientific Inquiry Process**.

The **Scientific Inquiry Process** is a type of scientific thinking that means using evidence from observations and investigations to create logical explanations and answer questions.¹¹

You've probably learned about the **Scientific Method** in your science classes but that is different than the **Scientific Inquiry Process**.

The Scientific Method is a step-by-step process to answer one question; and each time the experiment is repeated, it follows that same order:

1. Question
2. Observe/Investigate
3. Form a Hypothesis
4. Experiment
5. Analyze Data
6. Draw a Conclusion

The Scientific Inquiry Process, on the other hand, does *not* follow a consistent step-by-step process.

- It can be done in *any order* of asking questions, conducting investigations, collecting evidence, and developing explanations from the evidence.
- And, instead of communicating and defending results *at the end* of the process (as in the Scientific Method), communication is *constant* throughout the Scientific Inquiry process, communicating observations and findings at every stage.

We're going to use our observation skills and natural curiosity right now . . . *by looking out the closest window and describing what you see!*

Tips to get started – YOU MAY CHOOSE TO DESCRIBE:

- the landscape – e.g. flat, hilly, mountainous, shoreline, rock formations, etc.
- the trees and shrubs
- animals and insects
- weather (e.g. precipitation, cloud formations, etc.)
- water – both standing water *and* running water

NOW, it's time to get curious! Consider these questions and share and discuss your answers:

- What was the *first* thing you noticed when you looked out the window?
 - WHY did that stand out to you?
 - Provide details about how it looks.
 - Does the thing you noticed make sounds? *Why* does it make sounds?

¹¹ Donovan, M. Suzanne, and John D. Bransford. *Read "How Students Learn: History, Mathematics, and Science in the Classroom" at NAP.Edu. Www.Nap.Edu, The National Academies of Sciences, Engineering, Medicine Press, Oct. 2005, www.nap.edu/read/10126/chapter/2. Accessed 26 Oct. 2020.*

- Are there *lots* of these things, e.g. If you noticed a bird, do you see *many* of this type of bird at the moment? Or, is it the only example of this particular type of bird that you see in your area right now?
- What facts do you already know about this thing you noticed, e.g. If it is a tree, do you know which *type* of tree it is? If it is a bird, do you know which *type* of bird it is? If it is a mountain, do you know *why* this region has mountain formations?
- Take another close look at this thing – and now consider what you *don't* know about it! e.g. If it is a tree, you may wonder why some of the leaves are a different color or have holes in them. If it is an insect, you might wonder what it eats; or how this insect survives through the winter. You may wonder why the mountains have certain rock patterns, or why the rock layers are different colors. Be curious!

(Synchronous) Lesson 3 SMALL PEER TEAM ACTIVITY

We talked in our previous class about actions that scientists take. They:

- ask questions
- make observations
- conduct experiments
- gather and analyze data

Right now, you will work in Small Peer Teams to discuss possible ways in which you think you could use the Scientific Inquiry Process to learn more and gather information that could help you answer those questions you just asked yourself (about what you *don't* know about the thing you observed).

The instructor will divide the class into small groups of 2-3 students each, depending on class size.

Peer Teams will:

STEP 1 - DISCUSS

- **Each peer team member will present 1-2 questions they had about the thing they observed when they looked out the window.**

STEP 2 –CREATE A VISUAL AID (such as a poster or a 5-slide PowerPoint)

- **Determine *actions* (as noted above) that citizen scientists could perform to help study and answer those questions.**

For example:

- Citizen scientists could use a smartphone app to identify plant species in their neighborhood and track ones that are invasive. This would help scientists understand where invasive species are growing, and study factors that create an environment where invasive species can thrive.

STEP 3 – ORAL PRESENTATION

- Each peer team will present its ideas to the class in a 5-minute oral presentation.

(Asynchronous) Lesson 3 SMALL PEER TEAM ACTIVITY

The instructor will divide the class into small groups of 2-3 students each, depending on class size.

Peer Teams will:

STEP 1 - DISCUSS:

- Each peer team member will present 1-2 questions they studied for this activity.

STEP 2 – Create a visual aid (such as a poster or a 5-slide PowerPoint)

- Determine *actions* (as noted above) that citizen scientists could perform to help study and answer those questions.

For example:

- Citizen scientists could use a smartphone app to identify plant species in their neighborhood and track ones that are invasive. This would help scientists understand where invasive species are growing, and study factors that create an environment where invasive species can thrive.

STEP 3 – Present the visual aid to the class

- This may be done during a synchronous class period **OR** presentations may be posted to a Discussion Board*¹² and students have to review and comment on other teams' presentations.

Lesson 3 HOMEWORK

Peer Teams will work on the assigned activity.

As per the Scientific Inquiry process, Peer Teams will communicate their observations and findings at various stages of the activity, either through oral presentations *or* through Discussion Board*¹³ Posts.

TIP: The instructor may choose to devote one or more synchronous class periods to this Peer Team activity by creating Breakout Rooms during which teams work on the activity and the visual aid.

The instructor can supervise the Breakout Rooms *and* reconvene for a large-group meeting for Peer Teams to communicate their processes and observations (as per the Scientific Inquiry Process).

The instructor will determine an appropriate turnaround time for the synchronous or asynchronous activities; and will assign a schedule for Peer Team Presentations in a synchronous class; or, assign either a written or pre-recorded videotaped presentation for asynchronous students.

¹² *See Discussion Board Rubric at the end of this document

¹³ *See Discussion Board Rubric at the end of this document

Lesson 4 – Peer Team Presentations & Introduction Of Research Paper Assignment

PEER TEAM PRESENTATIONS

(Synchronous) Small Peer Teams will present their visual aids and discuss their findings from the LESSON 3 SMALL PEER TEAM ACTIVITY.

(Asynchronous) Students will be required to review and comment upon at least two other Peer Team's visual aids and presentations posted on the Discussion Board*¹⁴.

INTRODUCTION OF RESEARCH PAPER ASSIGNMENT

INDIVIDUAL STUDENT ASSIGNMENT – RESEARCH PAPER*¹⁵

Research one specific scientific study that relies on citizen scientists to assist in gathering data. Explain how the project monitors/researches its topic; the role citizen scientists play in that research; and how this citizen science collaboration enables researchers to make discoveries and advance science.

For this research paper writing assignment, each student will:

- **Choose a current or recent Citizen Science project to research**
- **Compile research from at least 4 different high-quality and academic sources (e.g. scientific website, encyclopedia, academic article, book, etc.)**
- **Create an OUTLINE for your research paper with information to:**
 - Explain which group or person is in charge of the research project; and what scientific question/theory/issue is being studied in this project. Note *which methods* are being used to collect data (e.g. field research, surveys, etc.).
 - Explain how citizen scientists are contributing to these efforts (e.g. conducting field experiments; sorting data online; making photo/video contributions to an online database, etc.)
 - Summarize the data that has been gathered and analyzed, and conclusions that were drawn by scientists as a result of this project.
 - Explain the impact and possible applications of this data.
- **Write a ROUGH DRAFT of your research paper**
- **Read and REVISE the rough draft.**
- **Create a Works Cited page.**
- **Neatly type your research paper and assemble the project in the following order:**
 - Title page – with your name and the title of the paper
 - Outline
 - Research paper
 - Works Cited page
- **SUBMIT your research paper according to the instructor's directions.**

¹⁴ *See Discussion Board Rubric at the end of this document

¹⁵ *See Research Paper Rubric at the end of this document

The instructor may wish to supply students with the following list of resources to help them identify and choose a citizen science project for the topic of their research papers*:

PBS Learning Media – NOVA LABS pbslearningmedia.org/collection/novalabs/?topic_id=1654

PBS Kids – SciGirls – Citizen Science Fun for All! Find a Project! pbskids.org/scigirls/citizen-science

CitizenScience.gov www.citizenscience.gov/#

National Geographic – Citizen Science Projects www.nationalgeographic.org/idea/citizen-science-projects/

Zooniverse www.zooniverse.org/

SciStarter.org/finder <https://scistarter.org/finder>

*Note that these are only suggested resources and do not suggest or imply an endorsement of those sites and/or their operators.

Lesson 4 HOMEWORK

Students will work on the assigned research paper.

TIP: The instructor may choose to devote one or more synchronous class periods to this research paper assignment, providing supervised time in which students conduct research, ask questions, deliver progress reports, and work on outlines and rough drafts.

The instructor may choose to conduct brief Breakout Room conferences with individual student during that time to address issues or assess student progress.

The instructor will determine an appropriate turnaround time and deadline for this research paper.

Lesson 5 – Lecture & Final Assessment/Assignment

We have studied the history of citizen science, and researched and discussed many different projects which rely on citizen scientists for data collection. We also have observed ways in which these collaborations and cooperation have advanced discoveries and the pace of new knowledge that benefit everyone.

Our final activity for this unit is for *you* to participate in a citizen science project*¹⁶!

For this FINAL ACTIVITY, each student will:

- Research and select *one project* to participate in as a Citizen Scientist.
- Write a 2-paragraph summary of the project, and what it requires its citizen scientists to do as part of its research.
- Participate in the citizen science project as required by the project instructions.
- Create a JOURNAL and make 4 entries describing and reflecting upon the tasks you are performing as a citizen scientist.
- Create a PowerPoint Presentation which includes:
 - A TITLE slide – with your name and the project title
 - The 2-paragraph summary of the project in which you are participating; and an explanation of how citizen scientists are contributing to the project.
 - Clearly explain what the research project is studying.
 - Provide the link to the project’s information page or website.
 - 4 x Daily journal entries
 - List and describe your responsibilities and tasks as a citizen scientist on this project.
 - Explain the data you gathered and how you recorded/shared it with the researchers
 - At least 3 ORIGINAL VISUAL AIDS to represent aspects of your participation in this citizen science project, e.g. a photo of yourself as you gather data according to the project’s instructions; a chart of data comparing and contrasting the data you have gathered; drawings of the equipment you used to gather data, etc.
 - Based on the observations you made and the data you gathered, *make a prediction* about what you think the final results of the researchers’ project will be.

THINGS TO CONSIDER as you complete this project:

- What **scientific practices** are used to collect data?
- What **mathematical practices** are used to analyze data?
- Which **English Language Arts** skills are used to communicate processes and findings *throughout* the scientific inquiry process?

¹⁶ See RUBRIC - FINAL PROJECT at the end of this document

- Which **Art & Design** skills help to best visualize and accurately communicate data (e.g. pie charts, bar graphics, photo comparisons, etc.)?

You will use the remaining class period to research and select a Citizen Science project in which you would like to participate.

NOTE: Each student must receive the **INSTRUCTOR’S APPROVAL** for your selected project, to ensure:

- the chosen citizen science project is age-appropriate.
- the tasks required for participation are feasible for students to complete.
- adequate participation can be completed within the time-frame of this classroom assignment.

Lesson 5 HOMEWORK

CHOOSE YOUR CITIZEN SCIENCE PROJECT and GET IT APPROVED BY YOUR INSTRUCTOR:

- Research and select *one project* to participate in as a Citizen Scientist.
- Write a 2-paragraph summary of the project, and what it requires its citizen scientists to do as part of its research.
- Submit this writing assignment to the instructor for **PROJECT APPROVAL**.

NOTE: Please **do not** begin work on the citizen science project until you have received approval from the instructor.

Once students receive project approval, they will begin work on this final project/assignment.

TIP: The instructor may choose to devote one or more synchronous class periods to this final project/assignment in which students work on their projects and the instructor conducts brief Breakout Room conferences with each student to discuss questions and hear progress reports.

(Synchronous) The instructor will determine an appropriate turnaround time and deadline for this final project/assignment **and** will assign presentation dates for each student.

(Asynchronous) The instructor will determine an appropriate turnaround time and deadline for this final project/assignment **and** will determine if/how students will present their projects, e.g. in writing; with a pre-recorded video presentation, posted on a Discussion Board, etc.

Lesson 6 – Peer Team Presentations

PEER TEAM PRESENTATIONS

(Synchronous) Students will present their final projects as per the instructor's schedule.

(Asynchronous) Students will be required to review and comment upon at least two other students' final projects posted on the Discussion Board*¹⁷

This unit will conclude with a Reflection Discussion about Citizen Science

- What is the value of having a large number of citizen scientists collect data from many different locations?
- What is the value of conducting long-term research studies?
- What, if anything, did you find challenging about **scientific practices** used to collect data?
- What, if anything, did you find simple and straightforward about **scientific practices** used to collect data?
- What **mathematical practices** did you (or scientists) use to analyze data?
- Which **English Language Arts** skills did you use to communicate processes and findings throughout the scientific inquiry process *and* the scientific method?
- Which **Art & Design** skills did you use to visualize and accurately communicate data (e.g. pie charts, bar graphics, photo comparisons, etc.)?
- Discuss the similarities and differences of **Art & Design** used to communicate data versus Art & Design done for artistic and creative purposes.
- Having studied and participated in citizen science projects, how would you describe citizen science to other young people?
 - Would you advise them to participate in it? *Why or why not?*
- Has your impression of, or assumptions about, citizen science changed from when we began this unit through now, as we complete and reflect upon it? *Why? How? Support your answer.*

¹⁷ See **DISCUSSION BOARD RUBRIC** at the end of this document

BIBLIOGRAPHY

“About CitizenScience.gov.” *CitizenScience.gov*, www.citizenscience.gov/about/.

“The Awesome Power of Citizen Science - YouTube.” *YouTube*, SciStarter, 16 Apr. 2016, www.youtube.com/watch?v=SZwJzB-yMrU.

“Citizen Science Toolkit.” *California Academy of Sciences*, www.calacademy.org/educators/citizen-science-toolkit.

Donovan, M. Suzanne, and John D. Bransford. Read “*How Students Learn: History, Mathematics, and Science in the Classroom*” at *NAP.Edu*. *Www.Nap.Edu*, The National Academies of Sciences, Engineering, Medicine Press, Oct. 2005, www.nap.edu/read/10126/chapter/2. Accessed 26 Oct. 2020.

Eldred, Sheila Mulrooney. “Kids Make Great Citizen Scientists.” *Science News for Students*, 3 Dec. 2019, www.sciencenewsforstudents.org/article/kids-make-great-citizen-scientists.

“History of Citizen Science.” *CosmoQuest*, cosmoquest.org/x/about-cosmoquest/history-of-citizen-science/.

H.R. Shah and L.R. Martinez. “Current approaches in implementing citizen science in the classroom.” *Journal of Microbiology & Biology Education*. Vol. 17, March 2016, p. 17. doi: 10.1128/jmbe.v17i1.1032.

National Geographic Society. “Citizen Science.” *National Geographic Society*, 9 Oct. 2012, www.nationalgeographic.org/encyclopedia/citizen-science/.

US Department of Commerce, NOAA. “Cooperative Observers.” *National Weather Service*, NOAA's National Weather Service, 11 Dec. 2012, www.weather.gov/bgm/cooperative.

RUBRIC - DISCUSSION BOARD

A discussion rubric guides students in writing original posts and replies to other students. To simply agree or disagree with other students is not sufficient.

Criteria	Unsatisfactory	Limited	Proficient	Exemplary	SCORE 1 - 4
Critical Analysis (Understanding of Readings and Outside References)	Discussion postings show little or no evidence that readings were completed or understood. Postings are largely personal opinions or feelings, or "I agree" or "Great idea," without supporting statements with concepts from the readings, outside resources, relevant research, or specific real-life application.	Discussion postings repeat and summarize basic, correct information, but do not link readings to outside references, relevant research or specific real-life application and do not consider alternative perspectives or connections between ideas. Sources are not cited.	Discussion postings display an understanding of the required readings and underlying concepts including correct use of terminology and proper citation.	Discussion postings display an excellent understanding of the required readings and underlying concepts, including correct use of terminology. Postings integrate an outside resource, or relevant research, or specific real-life application to support important points.	
Quality of Writing and Proofreading	Written responses contain numerous grammatical, spelling or punctuation errors. The style of writing does not facilitate effective communication.	Written responses include some grammatical, spelling or punctuation errors that distract the reader.	Written responses are largely free of grammatical, spelling or punctuation errors. The style of writing generally facilitates communication.	Written responses are free of grammatical, spelling or punctuation errors. The style of writing facilitates communication.	
Out of 8 POSSIBLE POINTS -- TOTAL					

RUBRIC – RESEARCH PAPER

<p>GRAMMAR CONVENTIONS: The writer uses standard writing conventions well to make the paper easy to read. There are very few errors, and errors that are made do not affect the accuracy or clarity of the paper.</p>	<p>_____ / 15 POINTS</p>
<p>ORGANIZATION, SENTENCE FLUENCY, and WORD CHOICE: The order of the paper makes sense and is easy to follow. Writing sounds natural and sentences have varied beginnings, lengths, structure, and rhythms. The paper uses appropriate vocabulary and word choice to convey information clearly and accurately.</p>	<p>_____ / 15 POINTS</p>
<p>ASSIGNMENT CONTENT/STRUCTURE ASSIGNMENT includes a TITLE PAGE, OUTLINE, RESEARCH PAPER, and WORKS CITED PAGE</p>	<p>_____ / 10 POINTS</p>
<p>RESEARCH PAPER CONTENT:</p> <p>(Introduction – 1 paragraph – 5 – 7 sentences long) Writer introduces topic in an interesting and engaging way; and summarizes what will be presented through their research.</p> <p>(Body – 3 paragraphs, each one 5 – 7 sentences long) Body paragraph follow the writer’s Outline. Each paragraph includes a topic sentence and important details and data to expand on and support that topic.</p> <p>(Conclusion – 1 paragraph – 5 – 7 sentences long) The writer restates main points of the research to effectively conclude the paper.</p>	<p>_____ / 60 POINTS</p>
<p>TOTAL POINTS EARNED & COMMENTS:</p>	<p>_____ / 100 POINTS</p>

RUBRIC – FINAL PROJECT/ASSIGNMENT

PowerPoint presentation based on Participation In Citizen Science project

CATEGORY	20 – Exceeds standards	15 – Meets standards	10– Approaches standards	5 – Below standards	1 - 0	#
Project Organization	Presentation includes all required elements, including evidence of full participation in a Citizen Science project, and an honest and accurate reflection of that in the PowerPoint.	Presentation includes all required elements, including evidence of full participation in a Citizen Science project. Presentation adequately reflects that participation but could use more details for clarity.	Presentation includes most required elements, including evidence of full participation in a Citizen Science project. Presentation requires significantly more detail, however, for clarity and accuracy.	Presentation is missing a number of key requirements to fully and accurately reflect participation in a clear or compelling way.	Student did not participate in a Citizen Science project; or, did not engage in the assignment fully or to a significant degree to fulfill requirements.	
Content / Accuracy	Presentation covers topic completely and in depth. Includes a Title Slide; 2-paragraph summary; 4 x Journal entries; list of responsibilities for Citizen Science project; explanation of data gathered and methods used; and, a prediction about final results of the scientific study. All work was cited properly.	Presentation covers topic but there are gaps in some areas that challenge clarity. All elements of the project are included but some could use additional details for clarity and depth. All work was cited properly.	Presentation covers topic but only in a general way. All/Most elements of the project are included but some could use additional details for clarity, accuracy, and depth. Citations were unclear or incomplete.	Presentation covers topic in a vague or unclear way. Some/Many project elements are missing, or could use significantly more details for clarity, accuracy, and depth. Work was not cited properly.	Student did not submit PPT.	
Use of Art & Design elements	Design and execution of PPT is appropriate and lends itself to clarity in its presentation.	Design and execution is appropriate but may be visually cluttered or unclear in	Design and execution is either cluttered and confusing, or too plain, detracting significantly	Design and execution is either cluttered or too plain, and does not adequately convey the	Student did not submit PPT.	

	Project includes the required 3 original images representing participation and/or data collection.	places, making it more difficult for the audience to understand. Project includes the required 3 original images.	from the audience's understanding of the information. Project includes required 3 original images.	required information. Project does not include the required 3 original images.		
Grammar/mechanics	No spelling, grammar, or punctuation errors. Text is in the author's own words.	Few spelling, grammar, or punctuation errors. Those that exist do not compromise the clarity or accuracy of the information	Some spelling, grammar, and punctuation errors, which may contribute to lack of clarity.	Spelling, grammar, and punctuation errors contribute to lack of clarity and to lack of accuracy.	Student did not submit PPT.	
Oral presentation	Student was well-prepared and clearly connected with and communicated information from the PowerPoint.	Student was adequately prepared and communicated information, although aspects of oral presentation could have been improved for clarity and/or audience engagement.	Student was somewhat prepared but did not always clearly communicate information. May have had trouble connecting with and/or communicating information being presented.	Student was not prepared and failed to clearly and accurately convey information to the audience.	Student did not give oral presentation.	
TOTAL POINTS EARNED & Comments: _____ /100 points						