Citizen Science

Turning curiosity into scientific research

Grade Level: 9th – 12th

Lesson Summary:

Citizen science is a critical component to many different scientific studies, and gives citizen scientists the opportunity to better understand the research and the process. In some studies, citizen scientists assist in major scientific discoveries that can change or create legislature. Students will participate in ongoing citizen science projects to learn more about the scientific method.

Standards:

SC.912.N.1.1 – Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Pose questions about the natural world.

SC.912.N.1.2 – Describe and explain what characterizes science and its methods.

SC.912.N.4.1 – Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.

LAFS.910.RST.1.1 – Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LAFS.910.RST.1.3 – Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

LAFS.WHST.3.7 & LAFS.1112.WHST.3.7 – Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Project Activity Assessment

Here is your chance to engage in citizen science. These cool projects will engage your students in discovering projects that inspire and motivate them. Most of these projects may be geared to general education students and advanced placement students. Have students pick out cool and interesting projects that stokes their intellectual curiosity, and let them find their own if those below do not interest them.

Procedure:

- Students should read the "Citizen Science" document prior to class, taking notes and referring to the vocabulary listed at the bottom of the reading.

- Students will be participating in citizen science projects. These projects may be long term, resulting in a more substantial report or presentation, or they may be done over the course of the next few weeks. Give them the option of picking one of the projects listed below, or let them find one themselves and have it approved by you.

- **Cyanobacteria Monitoring Collaborative:** A timely citizen science project sponsored by the Environmental Protection Agency to track and manage water quality and the occurrence of harmful algal blooms that may hurt bonefish, permit, and tarpon essential habitats. By collecting water samples, citizen scientists help scientists build baselines of cyanobacteria blooms and predictive models that may allow water quality experts determine when and where the next bloom will occur. This is a long-term project for students.

- **iNaturalist:** An observation-based project that can be accomplished as individuals or in groups. In this project, students are seeking out biodiversity in their communities. This may be accomplished in any ecosystem: wetlands, tidal, coastal, forest, grass field, or even the school yard. Findings reported through the iNaturalist app are shared with the Global Biodiversity Information Facility.

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Resources:

- https://cyanos.org/cyanomonitoring
- https://www.inaturalist.org
- https://www.bonefishtarpontrust.org/conservation/research/projects/juvenile-tarpon-habitat-mapping/
- https://www.nationalgeographic.com/
- https://scistarter.org/
- An article about Citizen Science with 100+ other projects: https://reefbites.wordpress.com/2020/01/28/citizen-science-facilitating-ocean-stewardship-and-enabling-widespread-monitoring-of-marine-ecosystems/

Procedure Continued

Juvenile Tarpon Habitat Mapping Project: Sponsored by the Bonefish & Tarpon Trust, this project is discussed in the student reading. Students may observe and report habitats where juvenile tarpon under 12 inches may be observed. This is a longer lead project and my not be practical for land-based students.

- Have students report on the following parameters below. Have them perform this in their science journal or create a presentation based upon the data they collected. Assessment should be managed by the rubric below.

Introduction

- Name of Project
- Mission/Goals of Project

Methods

- Dates of Participation
- Steps You Took to Carry Out Research
- How Did You Gather Data?
- How Did You Report/Share the Data?
- Tools Needed to do the Research

Conclusions

- What Did You Learn?
- What Was It Like to Participate in this Project?
- Was It Easy/Hard? Did it inspire?

Expansion:

You may expand this activity by asking the students to write a formal scientific report based on their project. This would include:

- Introduction, including hypothesis and objectives of the study
- Methods followed by the student to collect data
- Results (if applicable/available)
- Discussion of the implications of this data, either based off the results of the study, or based on what they expect they will find.
- Literature cited, including 1 – 2 scientific articles. They may use additional sources such as educational websites.

Citizen Science Project Rubric

AREA	1 Does Not Meet Expectations	2 Partially Meets Expectations	3 Meets Expectations	4 Exceeds Expectations
Science Content	NONE. Student does not understand the concepts of citizen science and did not understand the purpose of their project.	SOME. Student exhibits a basic understanding of citizen science but struggled to understand the purpose of their project.	MOST. Student grasps the concepts of citizen science and understood the purpose of their project but a key component was missing.	ALL. Student grasps the principles and needs for citizen science and fully understood the purpose of their project.
Use of Scientific Vocabulary	NONE. Student does not use any introduced concept or use scientific vocabulary to form thoughts and narrative.	SOME. Student attempts to use scientific jargon, but fails to use it properly or in context. Shows some mastery of science language, but fails to use effectively.	MOST. Student uses significant scientific jargon, but fails to identify all principles and concepts. Student exhibits some mastery of scientific concepts and vocabulary.	ALL. Student effectively communicates using scientific jargon and vocabulary to convey narrative. Student has achieved mastery of vocabulary and concepts.
Writing Fluency	Writing flow and errors in sentence structure are multiple, distracting from clear communication and narrative lacks thesis-driven structure	Writing flow is broken by ill-defined thesis and awkward sentence structure, making narrative hard to follow. Writing lacks sophistication and higher order thought.	Writing flow is clear and thesis is present. Sentence structure and clear transitions are present.	Writing flow and thesis are clear and direct. Narrative is easy to follow and author exhibits higher order of thought and understanding of scientific principles.
Completeness	Student did not address many of the bullet points on their project report, or did not fully answer many questions.	Most points were addressed in the project report, but many answers were incomplete or missing important concepts.	All points were addressed in the project report, but not all answers were complete or one important concept was missed.	All points were addressed in the project report, and answers were complete and covered all important concepts.

Citizen Science Presentation Rubric

AREA	1 Does Not Meet Expectations	2 Partially Meets Expectations	3 Meets Expectations	4 Exceeds Expectations
Introduction	Student does not demonstrate understanding of the purpose of the project and does not state what questions are being answered.	Student provides a basic explanation of the purpose of the project but does not clearly specify what questions are being answered.	Student mostly explains the purpose of the research and states the questions being answered, but the explanation is not clear	Student provides in-depth explanation of why the research was conducted, what the data will contribute to, and what questions are being answered.
Methods	Student does not provide an adequate description of what data was collected or how it was collected.	Student provides some description of what data was collected OR how it was collected, but does not describe both, and it is unclear how the methods relate to the purpose of the study.	Student provides a basic description of what data was collected and how it was collected, but details are missing OR it is not clear how the methods relate to the purpose of the study.	Student provides an in-depth explanation of what data was collected and how it was collected, and the connection to the purpose of the study is clear.
Conclusions	Student did not address all the points for the conclusion section.	Student addressed all the points for the conclusion section but did not provide full answers.	Student addressed all the points for the conclusions section, but did not include some details.	Student addressed all concluding points clearly and fully.
Completeness	Presentation was missing one or more section: -Introduction -Methods -Conclusions	Presentation contained all sections, but some sections were missing important information.	Presentation contained all sections, all important information was present, but some details were missing.	Presentation contained all sections, all important information and all important details.