

Lesson / Learning Plan

Lesson Title: A Night under the Stars

Duration / Time Frame: 30-minutes (self-guided)

Unit / Theme: Citizen Science and Astrophotography

Grade Level: Middle School Grades 5-8, but can be adapted for grades 9-12+

Teacher Prior Knowledge:

This will likely be assigned as an afterhours outside classroom activity. Teachers will need to know how to download the various Android and IOS Night Sky apps (Loss of the Night) and to use the web-apps for Night Sky Light Pollution and Smartphone Astrophotography. Teachers should introduce some of the concepts about light pollution, its effects, and how Citizen Scientists can provide valuable data in their observations.

Student Prior Knowledge:

Students will need to know how to download the Loss of the Night app to a smartphone or tablet or to use the Globe at Night web-apps via a desktop computer to record and upload observations. Students need to know how to use their smartphone camera in Manual or Pro mode to adjust exposure speed and ISO.

Lesson Overview:

This is a self-guided challenge for teaching users about the effects of light pollution, taking measurements of the night sky, and capturing an image(s) with their smartphone. Additional challenges include downloading and using innovative technology tools to make valuable contributions to science and research.

Content and Skills:

Concepts / Themes:

- To raise awareness about light pollution
- To capture an image of the night sky using a smartphone

Key Vocabulary:

Light Pollution, Glare, Sky Glow, Astronomy, Astronomers, Stars, Milky Way, Environment, Observations, Research, Data, Photography, Astrophotography, Exposure, ISO, Citizen Science, Collaboration

Essential Questions:

- Why is Light Pollution important?
- How is Light Pollution affecting our night sky?
- What is a Citizen Scientist?
- How can I capture an image of the night sky with my camera phone?
- How can I upload and share my observations, data, and images?

Learning Objectives / Targets:

Content: Students will know...

- How to use a mobile device to capture and upload an image of the night sky.
- How to use mobile devices to record and upload data.
- How to observe and recognize sources of light pollution in their local area.
- How light pollution reduces their view of the night sky.
- How light pollution affects the environment and everyone.
- How to compare observations in your local area and globally.
- How to describe the effects of light pollution.
- To understand the importance of researching and collecting data.
- To understand the importance of Citizen Science.

Process: Students will be able to...

- Identify and locate constellations with a night sky app
- Use their smartphones to upload their images.
- Capture an image of a constellation in the night sky with their smartphone showing light pollution.
- Compare personal observations (data) with other observations from classroom peers.

Relation to Space Exploration: Citizen Scientists can make observations of light pollution which provides ground truthing for satellite data. Participants can also observe, capture images and track satellite streaks that hamper our view of the night sky.

Science Concepts: Observation, Data Collection, Data Recording, Analysis, Global Collaborators

Next Generation Science Standards: Earth and Human Activity (4-ESS3-1), Earth and Human Activity (MS-ESS3-3, 4), Earth and Human Activity (MS-ESS3-3, 4), Earth and Human Activity (HS-ESS3-3, 4)

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and to use the web-apps for Night Sky Light Pollution and Smartphone Astrophotography. Teachers should introduce some of the concepts about light pollution, its effects, and how Citizen Scientists can provide valuable data in their observations and compare observations both locally and globally.

Non-standard materials: Smartphones, Night Sky web-apps

Instructional Plan:

This is an outside, after school hours, self-guided challenge for students to become Citizen Scientists in measuring the brightness of the night sky. Observations must be conducted on clear, moonless nights.

Background: We are losing the visibility of our night skies at an alarming rate. During this time of online/distance learning this is a fantastic time for teachers to engage and inspire their students to use technology for meaningful contributions to track/monitor light pollution in their local region. This session will introduce you to some top websites, web-apps, and tools you can start using in your virtual classroom to aid your students in becoming Citizen Scientists. You'll also learn how to capture an image of the night sky (astrophotography) with your mobile devices that help astronomers to measure light pollution.

Taking an image of the Night Sky with your Smartphone or Tablet tasks include:

Task #1: Download the Anecdata app onto your Smartphone.

Task #2: Download an app such as Planets by Dana Peters or any other sky observing app to find stars and constellations.

Task #3: Turn on your Smartphone or Tablet's GPS / Location Finder.

Task #4: Open your preferred sky observing app on your smartphone or tablet to find a bright constellation (i.e. Orion, Scorpius, Big Dipper, etc.).

Task #5: Once you have found the constellation of your choice and you can see it in the sky, open the camera app on your smartphone or tablet. The app will need to have a manual mode (sometimes called 'Pro') that lets you adjust the exposure speed and ISO value of your camera.

Task #6: Look for and select the "Pro" camera setting which is usually found near the shutter button as a "slider" (i.e. Photo, Video, Night, HDR, Pro, Panorama, and Continuous Shot).

Task #7: In the Pro settings set your camera to ISO 800 and an exposure time of 1 second.

(Note: Some older or native Smartphone cameras may not have these settings and/or may not have the sensitivity to capture an image of the night sky. You can download a camera app to give you more control over your camera's functions).

Task #8: Point your smartphone in the direction of the constellation you selected and use your native camera or 'camera' app to take a photo.

Task #9: Open your photo in your camera app and check that it shows as many stars as you can see with your naked eye.

Task #10: Adjust the ISO value manually and take another photo until your photo matches what you can see.

Task #11: Open the Anecdata app and search for the project “Night Sky Light Pollution.”

Task #12: Tap the “Observe” button

Task #13: Fill in the information about the Exposure time and ISO speed, and click on the appropriate check boxes.

Task #14: Tap the camera symbol and select 'Upload from camera roll' then find your image and tap it to upload.

Task #15: Tap 'Save' on the upper-right corner of the data page to upload your observation.

Task #16: Continue to make observations and take images each month during clear, moonless nights.

Task #17: Track your observations and others in the Night Sky Light Pollution app.

Assessments: Formative/Summative performance based assessments, formal and informal monitoring of student progress, how learning data is collected and used for teaching and personalized learning.

- Students can see their night sky images and others on the Scistarter or Anecdata websites under the Night Sky Light Pollution Web-app
- Students can see the plots of their observations on current maps and compare them to other locations.
- Students can also view their data at www.myskyatnight.com or on the Globe at Night web-app. <https://www.globeatnight.org/maps.php>

Useful Materials, Resources and Technology:

- Globe At Night - globeatnight.org
- International Dark Sky Association - darksky.org
- Anecdata.org or SciStarter.org
- Loss of Night app (Android or iOS)
- <https://scistarter.org/smartphone-astronomy>
- <https://scistarter.org/smartphone-astrophotography>
- A Guide to Smartphone Astrophotography: <http://spacemath.gsfc.nasa.gov>

Lesson Reflection:

How does this lesson empower students to take an active role in their learning?

This self-paced challenge inspires and engages students to learn more about the night sky and the effects of light pollution. It challenges them to become more aware of their surroundings and environment. Students will use their mobile devices to collect meaningful data and observations for a real world problem – allowing them to become a Citizen Scientist.

How does this lesson give students the opportunity to practice digital citizenship?

Students need to use reliable NASA resources that contain correct, valid observations and scientific information from a reliable source.

How does this lesson give students the opportunity to evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources?

With more practice students will achieve more accurate and consistent observations, thus providing meaningful data for scientific research.

What specific design process are your students using in this lesson to generate ideas, test theories, create innovative artifacts or solve authentic problems?

They are developing explanations and exploring real world data by exploring the sources of light pollution through their observations and data as well as data across the globe. This analysis of this data can be put into the perspective of a real world problem.

How are your students using collaborative technologies to connect with learners from a variety of backgrounds and cultures?

Learners are able to share their data and images with peers and a global audience. NASA JPL encourages creators, students, and Citizen Scientists to share their work.

How are students acting as computational thinkers by breaking problems into component parts, extracting key information and developing descriptive models to understand complex systems or facilitate problem-solving?

Learners are acting as computational thinkers by analyzing data collected from their peers and relating it to their environmental setting. They analyze the component parts of light pollution data by viewing it on generated maps which can later be used to create infographics that bring awareness to light pollution in their communities. The information they gather can be expanded to help facilitate learning.

How does this lesson allow students to communicate clearly and express themselves creatively?

Over time students will be able to bring awareness to others about the effects and impact of light pollution in their local area. In the long term, students can expand their observations and education to their community and educate others about how to conserve, protect, and preserve their night skies.

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