

Introduction

The non-profit EarthTalk created its Q&A project to leverage the power of syndicated media to promote environmental literacy, green living and climate mitigation. Professional journalists research and answer real reader questions on a range of environmental topics, citing experts and peer-reviewed research in the process of producing concise, easy-to-read explanations of the issues at hand—and what readers can do to help. The resulting “answers” are then distributed for re-publication to 1,200+ other media outlets, reaching some 30 million readers collectively every week.

EarthTalk in the Classroom brings the process of researching and answering environmental questions to students, building collective understanding of complex environmental issues in their own communities. Students work together to make observations, develop critical questions, research, and then share their work with others, promoting environmental literacy and awareness.

These modules break down the EarthTalk Q&A process into smaller components, which can be used in sequence or individually to support preexisting science curriculum and to fit the needs of students. These modules are meant to serve as supplemental resources to middle school environmental and social sciences curriculum.

Part One: Making Observations and Asking Questions

Divided into two independent modules, Making Observations and Asking Questions together make up the first step in the EarthTalk Q&A process. **Module 1: Making Observations** encourages students to take a closer look at their own environment, both built and natural. **Module 2: Asking Questions** challenges students to create a driving research question, inspired by their observations made in Module 1.

Learning Objectives

Student-generated Research

- Students will be able to make observations about their environment, both built and natural.
- Students will be able to ask questions that clarify observations or evidence.
- Students will be able to find resources to find answers to their research questions.
- Students will be able to compare and critique multiple arguments, and analyze or interpret facts presented to evaluate claims.
- Students will be able to explain what makes a good resource, evaluating sources for clarity, relevance, and bias.

Communicating and Distributing Results

- Students will be able to write informative short essay relevant to their research question, using the EarthTalk Q&A format.
- Students will be able to cite specific textual evidence to support analysis of sources.
- Students will be able to adhere to fairness in reporting and journalistic objectivity standards.

Environmental Justice

- Students will be able to make connections between phenomenon observed and the impact of human actions, infrastructure, and institutions.
- Students will be able to identify how local systems (ecosystems, communities, and economies) are affected by observed phenomenon, and explain various stakeholder perspectives.
- Students will be able to explain how communities, organizations, and governments can affect positive change within their community.

These modules support middle school learning performance expectations, as identified by the Next Generation Science Standards (NGSS); the English Language Arts Standards of the Common Core State Standards (CCSS); and Washington State’s Environment and Sustainability Learning Standards (ESE). Each set of modules will list specific practices, skills, or learning outcomes outlined by the NGSS, CCSS, and ESE.

Common Core State Standards

CCSS WHST.6-8.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Next Generation Science Standards

Disciplinary Core Ideas

- **Earth and Space Sciences (ESS)**
 - ESS-2 Earth’s Systems
 - ESS-3 Earth and Human Activity
- **Life Sciences (LS)**
 - LS-2 Interactions, energy, and dynamic relationships in ecosystems
 - LS-4 Biological Evolutions: unity and diversity

Crosscutting Concepts

Through making observations and asking questions, students may make connections to the following crosscutting concepts:

- **Patterns**
- **Cause and Effect**
- **Structure and Function**
- **Energy and Matter**
- **Scale and Proportion**
- **Systems and Models**
- **Stability and Change**

Science and Engineering Practices

- **Asking questions and defining problems**
 - Ask questions that require sufficient and appropriate empirical evidence to answer.
 - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
 - Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument.
 - Ask questions to determine relationships between independent and dependent variables and relationships in models.
- **Planning and carrying out investigation**
 - Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation or phenomenon.

Environmental Learning Standards

ESE Standard 1: Ecological, Social, and Economic Systems. Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.

ESE Standard 2: The Natural and Built Environment. Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

ESE Standard 3: Sustainability and Civic Responsibility. Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.

Module 1: Making Observations Walking Field Trip

Observations lay the groundwork for scientific research and are the foundation of our driving research questions.

Take some time- an hour, class period, or even as a homework assignment- for students to explore the built and natural environment surrounding your school (or home). Even a short walk will provide ample opportunities for observation, curiosity, and discovery.

During the activities students may benefit from working in pairs or small groups to inspire one another, share data and ideas, and collaboratively generate questions.

Duration

Intro: 15 minutes

Activity: 60+ minutes

Wrap up: 15 minutes

Materials

- Student activity sheet or notebook
- Pen or pencil
- Map of walking route (optional)
- Data collection tools (optional)

Things to consider:

- **Safety-** Choose safe walking routes; use sidewalks, footpaths, trails, and pedestrian zones. Cross major roads only with crosswalks and over/underpasses.
- **Time-** Observations and notetaking may take longer than expected. Plan short routes or have shortcuts back to school.
- **Permission slips-** If leaving school grounds, your administration may require parent/guardian permission slips.
- **Chaperones-** More teachers, aides, or chaperones can help guide student focus and allow groups to spread out.
- **Tools-** Encourage students to use data collection tools they are already familiar with (thermometers, rulers, etc.).

Setting your students up for success

Before activity:

- **Create a walking map** of your intended route. *If time permits, consider creating your route with students, students can use class computer or their own mobile devices to create and share maps.*
- **Discuss logistics**, timing, & important safety information.
- **Explain activity and outline expectations** for student-led research.
- **Calibrate students' focus.** Consider assigning general topics (i.e. pollution, "green engineering," urban wildlife, etc).
- **Make connections to prior learning** by encouraging students to look at particular features of the environment that relate back to topics previously explored in class.
- **Students should take notes** on the provided **student worksheet** or notebooks. *Encourage students to use different note taking styles (qualitative observations, quantitative data, drawings or diagrams, maps).*
- As with all EarthTalk in the Classroom modules, please **adapt all lessons and materials to meet the needs of your classroom.**

Types of observations

Help students get into the routine of making observations. These three phrases help set the stage for making observations:

- **I notice...** what do you see around you?
- **I wonder...** what questions does your observation inspire?
- **It reminds me of...** How does your observation connect back to prior learning or experiences?

Don't forget visuals! Sketches, diagrams, and maps are a great way to record observations.

Example:

Did your class recently discuss climate change and greenhouse gasses? Challenge students to look at where/how carbon dioxide is being produced around your school.

- What infrastructure or natural features of the landscape interact with emissions (sources or sinks)?
- What human behaviors or activities can they see that may impact emissions?

Module 1: Making Observations Student worksheet

We are always making

observations, sometimes without even knowing it. When you wake up you might notice the sunlight coming through the window. You notice the flow of traffic when crossing the street. You also are aware of changes to your surroundings like a friend's new haircut or the weather.

During this activity we are training ourselves to intentionally observe our surroundings and ask questions based on what we see. Your teacher may have assigned you a particular topic to focus on, but let your interests guide you.

Things to consider while making observations:

- How do the natural and built environments affect one another?
- How do people (or animals) interact with their environment?
- How does this environment change over time? Does it change from day to day or over longer periods of time?
- Does anything surprise you?

What is an environment?

The word environment often makes us think of natural places- like a forest or other green space. But environment simply means the surrounding features or conditions of an area- these could be natural, like plants and mountains, or built, like cities and roads. What does your environment look like? Depending on whether you live in an urban city, suburban neighborhood, or rural countryside, your environment might look very different.

Name:

Time:

Date:

Location:

Observation 1 _____

Observation 2 _____

Observation 3 _____

Module 1: Making Observations Student worksheet - EXAMPLE

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Name: *Emma*

Time: *1:05pm*

Date: *3/14/2020*

Location: *Forest Middle School*

Observation 1

The park appears to have less trees than the surrounding neighborhood.

*Why aren't there more trees in the park?
Can we plant more trees in public spaces?*

Observation 2

We counted 12 squirrels in the park at one time.

*Why are there so many squirrels?
Is there enough plants and trees for city wildlife?*

Observation 3

Many of the plants and trees by the busy road look unhealthy, compared to plants further away.

*Do city trees store carbon?
Do plants by the road pull in carbon dioxide from cars?*

Duration

Intro: 10 minutes
Activity: 60+ minutes
Wrap up: 10 minutes

Materials

- Student activity sheet or notebook
- Sticky notes
- Pen or pencil
- Blank space to display notes (table, wall, whiteboard, overhead projector)

Things to consider:

- Allow student interests and discussions to drive this activity.
- As students create research questions, introduce the concept of closed-ended (answerable with a yes or no) and open-ended (answer requires explanation) questions.

Module 2: Asking Questions Question Carousel

Creating your **research question** is an essential part of the EarthTalk Q&A format. These questions will drive student research and provide inspiration for students' answers.

A good research question:

- Illustrates crosscutting concepts at play within an environment such as patterns, cause and effect, etc
- Is answerable (students will research and answer their questions in subsequent ETC modules)
- Relate to local events/phenomenon or otherwise relate to students' lives
- Spark student interest

In this activity students generate research questions based on observations generated during Module One's Walking Field Trip. Students sort their observations and questions into topic categories. Students then work together to create driving research questions based on their topics, which they can then research and answer in Modules Two and Three.

Give students note cards or sticky notes and ask them to write down at least three questions related to their observations made during Module One's Walking Field Trip.

These questions could:

- Analyze how humans, animals, and plants impact or interact with their surroundings.
- Examine local actions, behaviors, or policies related to their observations.
- Explore the technologies or solutions that are being applied to observed environmental issues.

Based on conversations taking place as students work, create labels with general topic headings and place them within your blank space. *Based on student observations, topics may vary greatly.*

Ask students to look at their cards, do their questions fall within these categories? If so, place them below the topic label. *Students may create copies of their question and place in multiple categories, if applicable.*

Encourage students with remaining cards to compare their questions with a neighbor. Do their questions have any similarities? If so, create new topic heading labels and add to the table or wall. Students may split or lump topics as they see fit.

Assign or have students self-select into small groups, each choosing (or assigning) one of the topic headings. Students should reread and analyze their topic's questions, looking for similarities and patterns.

Challenge students to develop a single new question that incorporates the main points of their original questions, using the Student Worksheet or journal to record their progress.

Example: Last week, students completed their walking field trip, with particular focus on trees and plants. Students have recently finished a unit on greenhouse gasses and carbon cycling; in this unit, they learned about how plants can store carbon through the process of photosynthesis. In another previous science unit, students studied ecosystems and the crucial roles plants play- as habitat, food, and nutrient cycling within ecosystems.

Student questions vary but include the following:

- Why aren't there more trees in the park?
- Do city plants pull in CO₂ from cars nearby?
- Can we plant more trees in public spaces?
- Do city trees store carbon too?
- Do plants shaded by buildings photosynthesize less?
- Are lawns carbon sinks too?
- Why are there so many squirrels in the park?
- Are rooftop gardens good at storing carbon too?
- Are there enough plants and trees for city wildlife?
- Are all green spaces parks?
- What wildlife lives in cities?

From these you might choose to generate three topic headers: **City Green Spaces**, **Urban Carbon Sinks**, and **Wildlife in the City**. Students then sorted their questions accordingly.

City Green Spaces

- Can we plant more trees in public spaces?
- Why aren't there more trees in the park?
- Are all green spaces parks?
- Why do city buildings have rooftop gardens?

Urban Carbon Sinks

- Do city plants pull in carbon dioxide from nearby cars?
- Do city trees store carbon too?
- Do plants shaded by buildings photosynthesize less?
- Are lawns carbon sinks too?

Wildlife in the City

- What wildlife lives in cities?
- Why are there so many squirrels in the park?
- Are there enough plants and trees for city wildlife?

After discussing their remaining questions, students have decided to split **City Green Spaces** into two categories- **Human-made Green Spaces** and **Natural Urban Green Spaces**.

Urban Carbon Sinks

- Do city plants pull in carbon dioxide from nearby cars?
- Do city trees store carbon?
- Do plants shaded by buildings photosynthesize less?

Wildlife in the City

- What wildlife lives in cities?
- Why are there so many squirrels in the park?
- Are there enough plants and trees for city wildlife?

Human-made Green Spaces

- Can we plant more trees in public spaces?
- Why aren't there more trees in the park?
- Why do city buildings have rooftop gardens?

Natural Green Spaces

- Can we plant more trees in the city?
- Why aren't there more trees in the park?
- Are all green spaces parks?

Module 2: Asking Questions

Student worksheet

“Research questions deal with big ideas, changes over time, different points of view, ethical issues, etc. They typically deal with how and why, and combinations of these.”

Research questions often tackle big ideas or concepts, changes over time, different points of view, or issues that cause big impacts to communities or human behavior.

This might seem like the hardest part, developing your question. Use the questions you already have as inspiration for your driving research question. Talk to your classmates and friends. Maybe you’re looking at the same question from two different angles. Your peers are a great place to bounce ideas off of, learning from each other, and sharing your own personal experiences.

Take a look at your original questions, compare them with one another looking for similarities and common themes among them. Can you combine any questions?

Try to create one (or two) question (s) that focus on the bigger picture behind your original questions.

Tips on creating questions:

- Go beyond what can be answered in one sentence, instead use open-ended questions, which require more explanation.
- **Focus on the how and why** instead of the who, what, where, when.
- Connect this to ideas you may have already learned about in class, out of school, or in your own home.

A good research question should:

- Provide clear and relevant direction for your research.
- Be interesting and important: effective research questions lead to the discovery of interesting and important information. (and most importantly, the research question is interesting to YOU)
- Answerable: effective research questions match the resources and time available.

<p>List your original questions here</p>				
<p>Can you rewrite these questions to be open-ended (cannot be answered in a single sentence)?</p>				
<p>What similarities do your questions share? Can any be combined?</p>				
<p>Final research question</p>				