



THE TOOLS AND TECHNIQUES OF FIELD WORK

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Grade Level: 6-8th

Introduction: Students will visit multiple hotspots in the panoramas as they work to answer the question: *How do scientists collect data in the cloud forest?* Students will describe the techniques they encounter and link these to the tools used and types of data collected. They will also consider how different components of the research correlate to the stages of the inquiry process.

Major Themes: Science as inquiry

Connections to National Science Education Standards: Understandings about scientific inquiry (A); understandings about science and technology (E); science and technology in society (F); science as a human endeavor (G).

Time: 60 minutes (15 minutes for opening, 5 minutes to read handout, 35 minutes to work on handout, 5 minutes for closing/assessment)

Materials: Students will encounter still images of a scientist at work in many of the ground and canopy panoramas. In addition, students will need to view 3-5 of the following videos:

Panorama 1: Ground videos 3, 6; Canopy video 1

Panorama 2: Ground videos 4, 5; Canopy video 2

Panorama 3: Ground video 4

Panorama 4: Ground video 2

Panorama 5: Ground video 3

Panorama 6: Ground video 2

Additional Media: "Data Logger" video

Computers with internet access (at least one, preferably enough for one per pair of students)

LCD projector (recommended)

Student handouts (*The Tools and Techniques of Field Work* and *Student Assessment*)

Index cards (class set)

Objectives: Students will be able to: (1) summarize the stages of scientific inquiry; (2) describe several ways in which scientists conduct research in the cloud forest; (3) evaluate the strengths and weaknesses of various data collection techniques and tools; (4) relate a research question to the types of data scientists need to collect.



Potential Misconceptions:

- (1) Many students think that there is ONE scientific method, or series of rigid steps that a scientist must follow to conduct his/her research. While certain components of scientific investigation *are* indispensable, science does not always play out in a step-by-step fashion in real life. Instead, we use the term *inquiry process* to describe the approach scientists take when conducting research.
- (2) Often students think that there is a “right” or distinct answer that awaits a scientist at the end of his/her inquiry process. Students may be uncomfortable with the notion that scientists do not always know if they have arrived at a “right” answer, or any answer at all. More often than not, scientists have new data which may lead them closer to a truth about the natural world, but an answer is not certain.
- (3) Data that is unexpected or that does not support the original hypothesis is not wrong, and does not necessarily mean that the researcher made mistakes in his/her data collection process.

PROCEDURE

Opening: Before you begin this lesson, it is helpful to write the video information (panorama and video numbers) from the “Materials” section of this lesson plan on the board. Students will need to refer to this information later on.

Ask students to create a list of scientific tools. Allow a few minutes for students to think and write on their own, then ask them to turn to a partner to share their lists. After students have shared their ideas in pairs, solicit volunteers and record students’ ideas on the board. Once there is a thorough list on the board, ask students what these tools could help us learn about tropical montane cloud forests. Project a panorama from the *Canopy In The Clouds* website (or provide a photograph, preferably color, if projection is not possible) so that students may view the environment in question as they consider items from the class list. Encourage students to share their ideas with the class. For example, a student might see “meter stick” on the board and comment that a person could use a meter stick to measure the sizes of different leaves in the cloud forest.

Explain that in today’s lesson, students will use the *Canopy In The Clouds* website to explore the cloud forests of Costa Rica. Their mission will be to discover the tools that scientists use in the cloud forest and to understand the purpose of each tool. They will also witness a scientist participating in the inquiry process.

Development: Distribute *The Tools and Techniques of Field Work* student handout. Solicit volunteers to read the handout aloud. Next, use the computer and LCD projector to guide students to the appropriate *Canopy in the Clouds* resources. Address any questions that students have about the handout or assignment then review the example on the handout. This should include watching the video clip (panorama #1, hotspot #3).



Explain the terms “soil structure” and “biomass” and show students how to locate these using the glossary. Encourage students to use the glossary whenever necessary during this activity. Refer students to the list of videos (noted in “Materials”) from which they are to choose 3-5 clips. If students are working alone or in pairs at computers, you can then allow them to begin working on their own. Otherwise, work through the handout together as a class.

As students are working, circulate around the room and stop to interact with every student (or pair) at least once. Ensure that students are on task, following the handout instructions appropriately, and recording the key information. It is best to allow students time to collect the information from the videos at a reasonable pace. If three or four videos is a more reasonable goal for your class, please adjust accordingly.

Ask students to show you their data tables when they think they are finished and ready to go on to the next set of questions on the student handout. When the work meets your standards, allow students to begin working on the final pages of the handout. Students should plan to finish the handout by the end of class, or may finish it as homework for another date.

Closing: When there are 5-10 minutes of class time remaining, pass out an index card to each student. Ask students to write down one question, surprising fact, or other comment about their cloud forest discoveries on the index card. You may wish to have students write their names on the cards, or you may leave them anonymous. Ask students to hand their cards directly to you once they have completed the assignment. Next, revisit the list of tools that students generated at the start of class. Ask students how they might revise the list. If time allows, ask students what questions they would want to research if they had a chance to do field work in the cloud forests of Monteverde.

Suggested Student Assessment: (1) Give each student a copy of *The Tools and Techniques of Field Work: Student Assessment* handout. Students should complete this for homework. On the following morning, have students share their ideas with a partner and then discuss with the class. (2) The comments on students’ index cards will also be useful as a formative assessment.

Extending the Lesson: (1) Ask students to do some research to find out the names of any tools they did not identify by name during the *Tools and Techniques* lesson. (2) Invite students to write a letter to a cloud forest researcher to ask about his or her experiences in the field. (3) As students arrive to class the next day, have each draw one of the student comment/question index cards out of a pile. When all students are in class and have an index card, ask them to read the index card, flip it over, and write a response on the back. The response may be an answer to a question, a question about a comment, a shared sentiment, or something similar. If students wrote their names on the index cards



yesterday, ask students to print their names again at the end of their responses, and to return the cards to their original authors. Solicit volunteers to read the comments and responses on their cards.

Vocabulary: drab, pertinent, inquiry process, lab work, field work, terrain, implement other terms from glossary as necessary depending on video segment

WORKSHEETS: *The Tools and Techniques of Field Work* student handout and *The Tools and Techniques of Field Work: Student Assessment*