

SIEMENS STEM DAY ACTIVITY

DRONES IMPACT ON ECOLOGICAL STUDIES

OBJECTIVES

Students will be able to:

- Engage in research to learn about the variety of ecological settings that benefit from drone data collection.
- Use a Depth and Complexity framework to analyze the impact of drone use on ecological studies.
- Share learning and engage in analytical discussion within a small group.

THIS LESSON FOCUSES ON

Engineering Design Cycle

- Defining the Problem
- Communicating Results

21st-Century Skills

- Communication
- Critical Thinking

OVERVIEW

Students will conduct research to learn about the innovative and less invasive approach of using drones to study animals within their natural habitats. Using the Depth and Complexity framework, students will engage in an in-depth understanding of how technological advancements have led to the use of drones as effective tools in the field of ecological studies.

STEM incorporates Science, Technology, Engineering, and Mathematics to focus on real-world issues and problems guided by the engineering design process. This type of instruction supports students in developing critical thinking, collaboration, reasoning, and creative skills to be competitive in the 21st-century workforce.

Each Siemens STEM Day classroom activity highlights one or more components of the engineering design cycle and an essential 21st-century skill.

MATERIALS

- **Depth and Complexity Prompts** Handout—one per person
- **Depth and Complexity Frame** Handout—one per person
- Computers with internet access

HAVE YOU EVER WONDERED . . .

- How can drones be the answer to less-invasive ecological studies?
- How can we now gather information about wildlife that we previously knew very little about?

NATIONAL STANDARDS

<p>Standards for Technology Literacy</p>	<p>Standard 3: Students will develop an understanding of The Nature of Technology. This includes inquiring a knowledge of the relationship among technologies and the connections between technology and other fields.</p> <p>Standard 6: Students will develop an understanding of Technology and Society. This includes learning about the role of society in the development and use of technology.</p> <p>Standard 13: Students will develop Abilities for a Technological World. This includes becoming able to assess the impact of products and systems.</p> <p>SEP6: Constructing Explanations.</p>
<p>Next Generation Science Standards</p>	<p>HS-LS2-6: Evaluate claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.</p> <p>HS-LS2-8: Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.</p>

MAKE CONNECTIONS!

How does this connect to students?

Drones are rapidly growing in popularity. Student may think that the invention of drones is a current day innovation. However, they may be surprised to learn that the United States military began experimenting with the concept of drones back in 1917. This first pilotless airplane helped to pave the way for today's technological drone advancements.

How does this connect to careers?

An **ecologist** is responsible for studying how plants and animals interact with their environment. This role previously relied upon field studies, but are now using technology to remotely gather data and learn about various species. Ecologists often study environmental problems and design ways to improve the situation.

A **drone pilot** is not only responsible for driving and controlling the drone, but also overseeing vehicle safety and performance. This role may involve operating a camera or other data collection tools. This is an upcoming industry that will continue to be influenced by technological developments.

How does this connect to our world?

Drones are changing the world in which we live. From fighting war to disease control and forecasting weather, drones are now able to perform increasingly complex tasks.

BLUEPRINT FOR DISCOVERY

1. To engage students in what they will be learning, present a picture of a drone and ask them to share what they know about drones and their uses. Drones are often referred to as flying robots that may also be called unmanned aerial vehicles (UAV) and unmanned aircraft systems (UAS). Some common uses for drones include aerial photography, geographic mapping of locations and terrain, express delivery, and military uses. However, many people are not aware that drones are now being used for ecological studies of plants and animals within their natural habitats.
2. To further students' understanding of the history behind drones, show them the video called The History of Drones. <https://www.youtube.com/watch?v=Ab9Nm4CXmL0>
3. Ask students to create groups of four students to work with for this activity. You may choose to select groups in advance, but it is not necessary to do so.

4. Use the **Depth and Complexity Prompts** Handout to introduce the 11 different icons to the students. Explain that each icon is used differently to help critically analyze a topic or article. This is a differentiated approach since students can select to challenge themselves according to their own comfort level of analysis.
5. Tell students that there are two articles about the impacts of drones on ecological studies. Two students will read Article 1 and the other two students will read Article 2. Encourage them to select who would like to read which article. The options include:

Article 1: Drones are Changing the Face of Ecology

<https://www.the-scientist.com/notebook/drones-are-changing-the-face-of-ecology-64527>

Article 2: Drones May be the Answer to Less-Invasive Ecological Monitoring

<https://www.fisheries.noaa.gov/feature-story/drones-may-be-answer-less-invasive-ecological-monitoring>

- o Please Note: More advanced readers may opt to read one of these two article case studies instead of either of the above articles.

The Drone Revolution of Shark Science: A Review

<https://www.mdpi.com/2504-446X/5/1/8/htm>

Going Batty: The Challenges and Opportunities of Using Drones to Monitor the Behaviour and Habitat Use of Rays

<https://www.mdpi.com/2504-446X/5/1/12/htm>




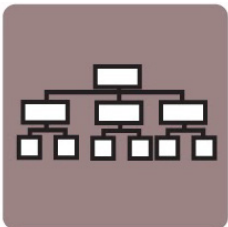
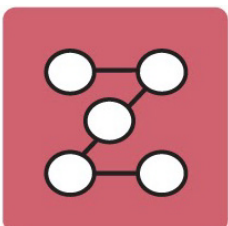
6. Pass out **Depth and Complexity Frame** Handout. Direct students to work together with the other person in their small group who is reading the same article. This jigsaw strategy allows students to become the experts on their selected article. They are to first read the article and then complete the handout.
7. Once everyone in the small group has completed this task, they are to share what they learned with their other group members. Encourage students to engage in a group discussion about their learning.
8. Conclude the lesson by instructing students to complete a 3-2-1 reflection. This can be done orally or written on paper. What are 3 things that you learned? What are 2 things that interest you and you'd like to learn more about? What is 1 question you still have?

TAKE ACTION!



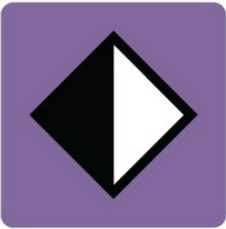



Ask students to take action by researching other beneficial uses of drones that can help to solve a local, regional or global problem. Encourage them to create a new drone prototype that would help address the identified problem.

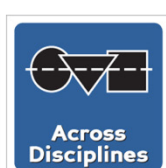
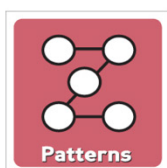
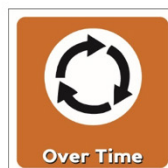
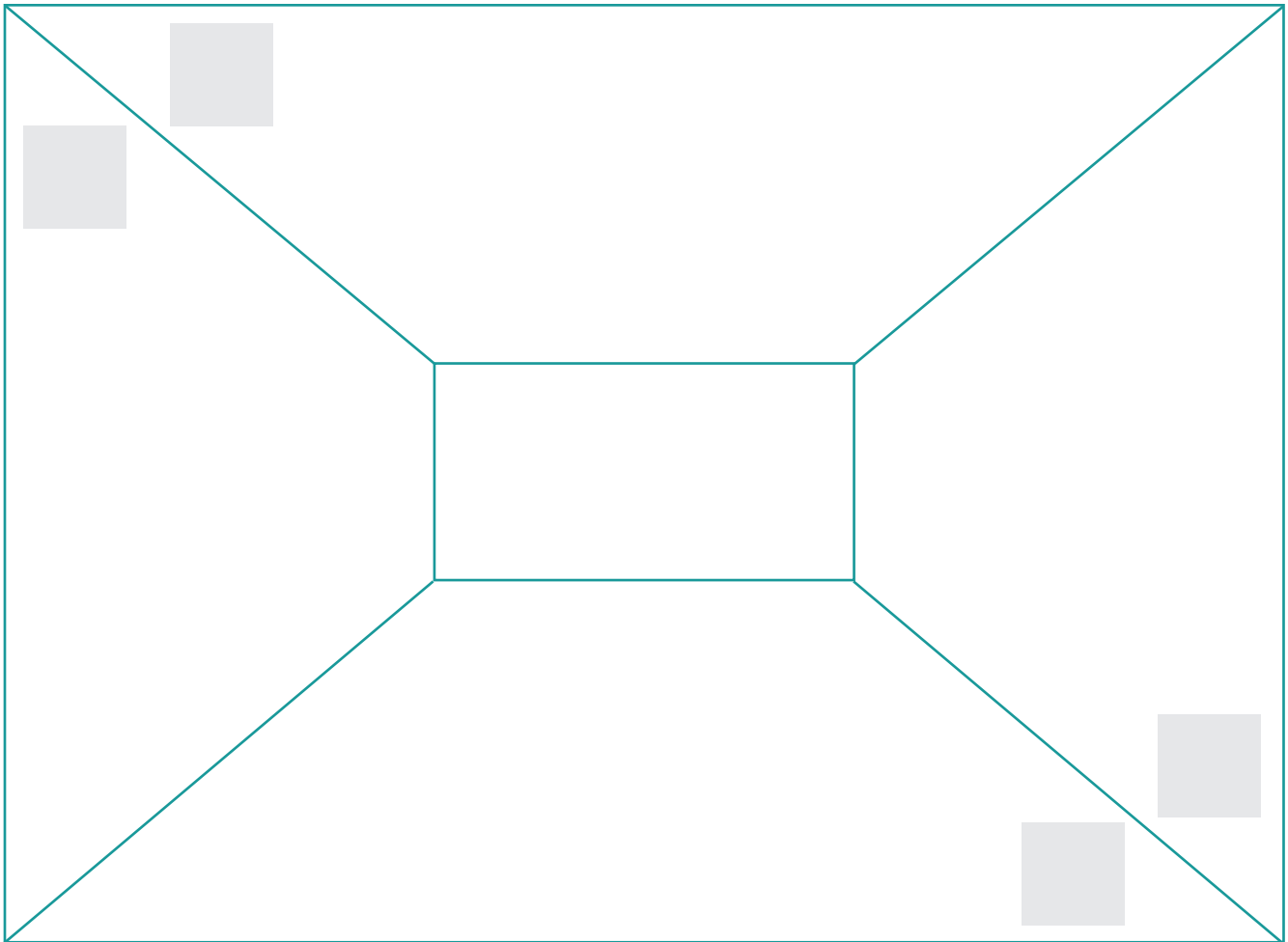
DEPTH AND COMPLEXITY PROMPTS

<https://docs.google.com/document/d/1k1mORJOxfcbkuBuKejR0y8fnYVkuh8dpvUD24typjQU/edit>

Name	Icon	Sentence stems to get me thinking about this icon
Details		<p>The most important ideas were ____</p> <p>The things that distinguish this topic from another are ____</p> <p>The attributes of this are ____</p> <p>The features that characterize this are ____</p> <p>The important clues that help me understand the big idea are ____</p>
Big Ideas		<p>The big idea of this was ____ because ____</p> <p>The evidence that supports the main point is ____</p> <p>The importance of what we are studying is ____</p> <p>This was mostly about ____</p> <p>The universal theme is ____ because ____</p>
Language of the Discipline		<p>The words that are specific to this work are ____</p> <p>The new terms I encountered were ____</p> <p>The tools that experts in this discipline would use include ____</p> <p>Definitions for these terms are ____</p> <p>These words could be broken into the categories ____ because ____</p>
Rules		<p>The rules that seem to be present are ____ because ____</p> <p>The statements of truth (all/most of the time) about this are ____</p> <p>I could categorize the rules ____ into these categories:</p> <p>The usual course of action/behavior are ____</p> <p>The methods/steps that must always be followed are ____</p>
Patterns		<p>I would describe the patterns to be ____</p> <p>It can be predicted that ____ will come next because ____</p> <p>A recurring theme seems to be ____</p> <p>The details that help me understand the patterns are ____</p> <p>I know this can be replicated because ____</p>

DEPTH AND COMPLEXITY PROMPTS (CONT.)

Name	Icon	Sentence stems to get me thinking about this icon
Trends		<p>The general direction of the information shows ____</p> <p>The tendencies are ____</p> <p>The data shows support for ____</p> <p>The most significant trend I see is ____ because ____</p> <p>The relationship among these trends is ____ because ____</p>
Unanswered Questions		<p>The unknown details of this were ____</p> <p>Something unexplained by this was ____</p> <p>I am uncertain about ____ because ____</p> <p>The missing information is ____</p> <p>Some evidence that might answer these questions is ____</p>
Ethics		<p>The ethical issues I found include ____</p> <p>Some controversies in this were ____</p> <p>I noticed bias when ____</p> <p>Some examples of “appropriate” behavior are ____</p> <p>Morals and values that are present are ____</p>
Multiple Perspectives		<p>Other people might view this issue by saying ____</p> <p>Another point of view would be ____</p> <p>This would be different if it was viewed by ____ because ____</p> <p>An expert on this topic might say ____</p> <p>I would report this differently if I were ____ by saying ____</p>
Over Time		<p>I can describe the past, present, and future of this by saying ____</p> <p>A time that this topic/idea was different was ____</p> <p>Because of the past experiences, I predict that ____ will change because ____</p> <p>At the start I noticed ____ but now I see ____</p> <p>Because of the way ____ developed, it is likely that ____</p>
Across Disciplines		<p>This topic also relates to ____ because ____</p> <p>An idea from this that can be seen in other subjects is ____</p> <p>The relationship between ____ and ____ show ____</p> <p>Experts in this discipline would also need help from ____ because ____</p>



Directions:

1. Select four different Depth and Complexity Icons to use in your analysis of the article.
2. Draw a quick sketch of the icons you chose.
3. Use the sentence stems from the Depth and Complexity Prompts Handout to create an analytical response to the article.