Lesson plan: Using drones in the classroom

Engage (45 minutes)

Materials

Computer with projector for playing videos and visiting websites
Board or chart paper for writing down student ideas
Brainstorming pdf

Part One- Background on plant needs and drone usage

1. Gather understanding of student prior knowledge with a conversation about what vegetation needs to survive. Give students one minute to generate as many ideas as they can. Create a brainstormed list on the board from individual student lists.
2. Ask students, “What are some forces that could impact survival, growth, and health?” Again, give students some thinking time (two minutes) then add ideas to the brainstormed list. (Choose students who did not add an idea to the original list.)
3. Ask students, “How do people in agriculture monitor the vegetation in their fields?” (Many students may have NO idea how they do this, so some prompting might be necessary; be sure to encourage all ideas.) Create a brainstormed list and prompt students to consider various crops, sizes of farms, and changing methods over time for surveying crops.
4. Introduce the idea of drones being used to survey land and vegetation with this video- https://www.britannica.com/video/193339/drones-agriculture-crops-condition
5. Ask students “What questions do you have after watching this video?” Add to the brainstormed ideas on the board.
6. Follow up by viewing this video- https://youtu.be/wUBxcXSM6wc
7. Ask students for what ideas and what careers they heard about from watching this video. Ask them to note the careers in a different color. Add to the brainstormed ideas on the board.
8. Let’s look a little deeper into the technology that can help us with this, DroneDeploy. Visit the website at https://www.dronedeploy.com/
    1. Watch the intro video on the main page (about 1 minute).
    2. Visit the “Solutions” tab at the top and explore some of the other fields that work with Drone Deploy.
9. Ask students for what ideas they have from this video and site overview. Add to the brainstormed ideas on the board.

Part Two-What is in our area?

1. Pose the question to students, “Do we have agricultural areas around us?” “Where are they?” Discuss.
2. Explore the area through Google Maps searching for various land use, specifically agricultural use. (If students have their own devices, they can do this independently.)
3. Review the findings of this exploration. If there are agricultural areas around the school/community, highlight them in the discussion. If there are not any areas close by, challenge students to find these areas.

Explore (Two classes of 45 minutes)

Materials

1 or more Tello Drones
Additional battery
Charging Hub
Pop Guards
For the Tello EDU kit and materials, visit https://www.ryzerobotics.com/tello-edu

Drones in the Classroom

Device for programming Tello drones- Visit https://www.dji.com/downloads/djiapp/tello-edu for the TELLO EDU app information and supported devices
OR use the DRONE BLOCKS app for block based coding as well
Drone mechanics pdf

Safety Equipment
Eye protection (in the event of a prop flying off the drone)
Caution tape to mark off flight area
Students with longer hair should have a hair tie to pull back hair to minimize risk of getting tangled in the props

Day One

Learn the science behind drones-

1. Begin by asking students to discuss in small groups (3 students in a team is ideal) how they believe drones work. What is the science behind their ability to fly? Are they exactly like planes? How are they similar to birds?
2. Give students 5-10 minutes to discuss their ideas and ask them to draw out an image showing what they understand about how drones fly. Encourage the use of labels and arrows to show direction and meaning. Prompt students to write any vocabulary words that make sense for this topic. Also, ask students to add detail to the drone in terms of what powers the drone, how is it controlled, what do the props look like and how they move.
3. Pair up teams to share their drawings. (5 minutes)
4. Finally, give students time to complete research on their own devices for how drones work. They can use websites, videos, and images to add to their drawings. (10 minutes)
5. Review student work and have a whole class share. Be sure to highlight the information regarding-
   a. Controlled by external device (computer, controller, etc) with either programmed code or manual flight.
   b. Share an image such as the one below for reference.
   https://phantompilots.com/attachments/1561113362226-png.112200/ (insert image)
6. Next, identify the physics in the airflow. Begin by identifying the direction of the props.
   https://www.dronezon.com/wp-content/uploads/2017/11/How-A-Quadcopter-Flies-Using-Propeller-And-Motor-Direction-e1580563822230.jpg
7. Finally, identify the movement of the drones by overviewing this Google Slide Presentation-
   https://docs.google.com/presentation/d/10Kt--13OJjqOGDdiL_gxHQzX5DCjfP-9t3UN-fs6NfY/edit?usp=sharing

Learn a little about the drone-

1. Allow students to view the drone(s) that they will be using for the challenge.
2. Show the prop directions and lightly blow over top of the props to show prop movement. Students should observe the difference in the prop rotations.
3. Show the software that will be used for programming the drones by visiting the TELLO EDU app and the DRONE BLOCKS app. Use any time permitting to demonstrate the method of connecting and how to create a simple block code.
4. Also, share with students the safety concerns with using the drones (cleared space, hair pulled back, eye protection on, and communicating flight plans).
5. Practice these safety procedures!

Day Two

1. Use a full 45 minute class period to allow students to rotate through practicing-
   1. Connecting and disconnecting to the drones to either of the apps
   2. Lifting and landing
   3. Using code to navigate a simple flight plan

Drones in the Classroom

Explain, Extend, and Evaluate (Two-four classes of 45 minutes)
Materials

Large chart paper and markers for creating indoor simulated fields
Sidewalk chalk and large space outside for creating outdoor simulated fields
Challenge: Using a drone in agriculture pdf

Challenge: Can your drone team successfully program and fly a drone to survey a field of crops for stress in plant life?

After giving students this problem, the class needs to:

1. Create the simulated field of crops. This can be done in a variety of ways. One option is to use large chart paper or bulletin board paper that is decorated and taped to the floor. Students should use construction paper to create some "healthy" looking crops and an "unhealthy" area. Another method is using outdoor space and sidewalk chalk to draw out the area.
2. Use the TELLO EDU app or the DRONE BLOCKS app to create programs for flight. The drone should move back and forth across the field in a slow, organized manner to simulate the capturing of footage. Remind students to create pause commands and rotate the drone appropriately through the coding. (Both apps allow for block based coding and have advantages. Allowing students to choose the app they prefer is an option.)
3. Test programs for flight.
4. Challenge students to program the drone to not only fly successfully in a back and forth manner across the simulated field, but also capture photos of the field to share on the board.
5. Celebrate successful flights and debrief on the how, why, and possibilities of drones in agriculture!

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