Expectations:
- uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

When asking questions try to keep them general to stimulate student exploration and discussion
(Try not to just give the students the answers).

Model Drone Experimentation Question
Question: How can you create a wifi pair between a specific drone and a specific controller?
(Please note that this question needs to be modified a little to help guide experimentation related to a specific cause and effect relationship).

Think Aloud For Teacher to say to students after providing students with 5-10 min of discussion time related to the Questions above:
It is essential to guide students through the process of developing good problems for experimentation. Try walking them through the following description by saying it aloud:
“I’m not sure how to pair the controller to the drone but I would like to try changing just 1 part of the controller to see if it connects/pairs the drone to the controller. After turning on the drone and the controller, the 1 part of the controller that I want to change is the left joystick. I want to see if moving the left joystick up 2 mm will connect/pair the drone to the controller. Now, I need to write my statement, so it can easily be answered with a 'yes' or 'no' hypothesis statement.”

Problem: If I turn on a controller first, turn on a drone, and move the left joystick (of the controller) up 2 mm, then will this pair the controller to the drone?

Guide students as you model how to use key parts from the problem statement to create a complete hypothesis statement. This statement is essentially an educated guess. After students have had 5-10 minutes of discussion time, related to the question, they have to use their vast experience:) to write their educated guess (hypothesis). Ask students what they think might happen and to record their own Hypothesis in their Model Drone Experiment gDoc (Create a Google Classroom Assignment and it will auto-generate gDoc template copies for all of your students - here is a template for you to attach to your Model Drone Experimentation in your classroom) - or if tech isn’t readily available, use paper or the blackboard:)

Hypothesis: Yes, turning on the controller, turning on a drone, and moving the left joystick (of the controller) up 2 mm, will pair the controller to the drone.

Materials: (Here are the materials and pricing that you could use to get your class started - I ran experiments in groups of 3 with 9 drones)
   1. Drone (fully charged)
   2. Wifi Controller
   3. 2, fully charged AAA batteries (for controller)

Procedural Controls:
Expectations:
- uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

1. Make sure that the controller is no more than 1 m away from the drone.
2. Do not manipulate any other controller or drone parts when attempting to pair the controller to the drone.
3. Make sure that the left joystick on the controller is in the down position.

4. Make sure that the right joystick on the controller is in the middle (standing straight).

5. Make sure that the drone blades are all perpendicular to the vertical support below them.
Expectations:
- Uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

Safety:
Be sure that no fingers are touching the drone when attempting to pair it with a controller.

Procedure:
1. Placed Drone A on desk.
2. Picked up controller A.
3. Measured and set distance between Drone A and controller A to no more than 1 m.
4. Turned on controller A by moving central switch to the ‘on’ position.
5. Waited 5 seconds.
6. Turned on Drone A by moving central switch to the ‘on’ position.
7. Moved left joystick on controller A up, 2 mm from the down position.
Expectations:
- uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

8. Recorded Observations in chart: [Observations Chart Link]  [Blank Observation Chart]
9. Moved left joystick on controller B all the way down.

10. Turned off the controller by moving the central switch to the ‘off’ position.

11. Turned off the drone by moving the central switch to the ‘off’ position.
Expectations:
-uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

Analysis of Observations (Careful review of qualitative and quantitative data for evidence to help prove or disprove the hypothesis).

HERE IS A LINK TO A MODEL GDOC TEMPLATE YOU CAN SHARE WITH YOUR CLASS FOR GROUP SHARING OF THEIR EXPERIMENTAL ANALYSIS AND CONCLUSIONS!
Expectations:
- uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

Conclusion (Do you accept or reject the hypothesis? Why? Why not?)

Next Step….
Design your own Problem and hypothesis and design and conduct an experiment to test the hypothesis.

Your independent experiment will be evaluated using the follow expectations:
- the problem must have something to do with testing the forces of flight (e.g., lift/thrust)
- uses scientific inquiry skills to describe and justify the validity of a hypothesis using relevant, detailed observations collected via experimentation and extends the solution by including relevant, researched evidence from other sources (E.g., Scientific articles, websites, engineers)

To support Teachers with instructions and evaluation:
- [How to include MLA citations in gDocs](#)
- [How to set up Doctopus/Goobric in gSheets](#) for student assignment evaluation
- [General Experimentation Rubric](#) you could use when completing summative evaluations (Already formatted for Doctopus/Goobric use)
- [Copy of a Student Model Experimentation Report](#) (Thanks Navuday!)
- [Copy of a Student Model Observation Chart](#) for Experimental Report (Thanks Navuday!)

Want to learn more about GAFE products? I can send you some useful resources! **Just request them here!**