PAPER AIRPLANE CARGO RACE ELEMIENTARY SCHOOL LEVEL 2

Who doesn't love paper airplanes? My favorite way to pass time as a kid, and I had dozens of styles that all flew differently. In this project, students will make paper airplanes and use them to fly cargo. Let's see who can make a plane to carry the most weight the furthest distance.

EDUCATIONAL STANDARDS:

NGSS CONNECTION:

5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

COMMON CORE CONNECTION: ELA/Literacy

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

W.3.7 Conduct short research projects that build knowledge about the topic.

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Mathematics

MP.2 Reason abstractly and quantitatively.

MP.5 Use appropriate tools strategically.

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

DOK:

Level 2: Concept Level 3: Strategic Thinking Level 4: Extended Thinking

MATERIALS NEEDED:

- Paper
- □ Tape
- Coins
- Paperclips

DIRECTIONS:

- 1. Draw a sketch of the plane you're building.
- 2. Add to your sketch the areas you would place weight; hypothesize why these are the best places to add your load.
- Start building your planes. After taking some test flights, build a plane that flies well and start attaching your weights.



After some test flights, have students add some more weight, try for further distance, and rebuild until they have a plane ready to race. Now line up in groups and let them fly! Who can get the furthest carrying the most cargo? What was it about their plane that made it fly the best? What other designs were close, and why?

OBJECTIVE:

Students will be able to design paper airplanes to support an argument that gravity is always locally directed downward.

ESSENTIAL QUESTIONS:

- What causes objects to fall?
- How might we counter the effects of gravity?



- A. The largest cargo plane in the world is the Antonov An-225 Mriya, which can take off with up to 640 tons.
- B. The first FAA-approved drone delivery was in July of 2015.
- C. The first-ever air cargo flight was in 1910.

ENGAGE / EXPLORE:

- 1. Ask students (intentional repetition from Balloon Race exploration)
 - a. How might we design an airplane to transfer materials?
- 2. Take the students outside and have soccer balls for them
 - a. Have them make several predictions (they may share predictions)
 - i. What will the ball do if we leave it there?
 - ii. What will happen if we kick the ball?
 - iii. What happens if we drop the ball?
 - iv. What happens if we throw the ball?
 - b. After students make their predictions, they should conduct a test by doing the tasks
 - c. After each task reflect with students.
 - i. What did the ball do when we left it there?
 - ii. What happened when we kicked the ball along the ground?
 - iii. What happened when we dropped the ball?
 - iv. What happened when we threw the ball?
 - d. Students will answer the same questions as with the Balloon Race, guiding them to new information.
- 3. Evaluate
 - a. Students' predictions
 - b. Students' observations
 - c. Students' reflection



EXPLAIN:

- 1. Use drawings with arrows to describe forces in each scenario with students
 - a. Have students practice drawing directions of the forces in various scenarios
 - b. Have students identify patterns in unbalanced and balanced scenarios.
 - c. Concentrate on forces vertically as well as horizontally
- 2. Demo several scenarios and have students predict the direction of the
 - a. Pencil sitting on the table
 - i. Talk about balanced vertical forces (why the pencil doesn

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- b. Two students push a box against each other
 - i. Talk about vertical balanced set (the earth's urface gravity)
- c. Two students pushing a box together
- d. Airplanes' ability to fly
 - i. Wings providing upy
 - ii. Motion forward
- 3. Evaluate
 - a. Students responses and predictions
 - b. Identification of force arrow directions.

ELABORATE:

- 1. Students create their airplanes
 - a. They can make several different designs
- 2. Students make predictions of the motion
 - a. Draw pictures with arrows to show the direction of force
 - i. When launched
 - ii. In-flight
 - iii. At stall
 - iv. Falling
 - v. Crashed
- 3. Students conduct trials of their airplanes
 - a. Use observation to determine force arrows for the above scenarios
 - b. Make conclusion from evidence of gravity and other forces present
 - i. Support reasons for why the plane flies temporarily
 - ii. Support why it falls
- 4. Let them fly!
 - a. They can make modifications to vehicles or balloons
 - i. Ask for reasoning
- 5. Evaluate
 - a. Predictions
 - b. Observations
 - c. Explanations
 - d. Design of airplane to counter the effects of gravity

