Bay Area Scientists in Schools Presentation Plan

Lesson Name What Makes Things Fly?
Presenter(s) Paul Smythe
Grade Level 2
Standards Connection(s) Physical Science: Motion can be changed with force

Abstract: Building and flying paper airplanes is a great way to learn about basic aerodynamics. What's more, the principles behind paper airplanes are the same as those that shape the design of all aircraft! Students will learn all about lift, drag and thrust from a real flight instructor while experimenting with variations on a basic airplane design!

Vocabulary/Definitions:
- Lift
- Drag
- Weight
- Thrust
- Streamlining

Materials:
- Paper Airplane Templates
- Fan
- Cardboard

Classroom Set-up:
- Groups of 3-4
- 10-15 Feet for Flight Testing

Classroom Visit

1. **Personal Introduction:** 5 **Minutes**
   Senior at Embry-Riddle Aeronautical University
   Commercial Pilot and Flight Instructor
   I wanted to be a pilot when I was little

Topic Introduction: 5 Minutes
Anyone ever been in an airplane? What do you think makes them fly?
Anybody might want to fly one?

2. **Learning Experience(s):** 25 Minutes
   1) Demonstrate the four forces acting on an airplane with the cardboard and fan.
   2) Build the paper airplane and change the features to experiment with flight characteristics.
   3) Kids will make their own.

3. **Wrap-up: Sharing Experiences and Building Connections** 10 Minutes
   Kids will see each others paper airplane fly and review the new terms

4. Close: 5 Minutes

Q&A, Thank you and Goodbye!

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about Airplanes?"

Family Flyers, 4-H Aerospace Lesson – Includes templates for 2 different types of paper airplanes and some questions to guide follow-up discussion. http://4h.uwex.edu/pubs/showdoc.cfm?documentid=4329

Nosedive, Oregon Museum of Science and Technology – Investigate the basics of lift and drag as they pertain to flight. – http://tryscience.org/experiments/experiments_nosedive_athome.html

What's Going On

It's important to realize the basics of why paper airplanes fly, and why full size airplanes fly, are identical. They create lift and drag, and are stable or unstable for the same reasons.

Lift: Air molecules travel farther over the long top of the wing. Since the air molecules on the top surface of the wing have to go farther in the same amount of time, they are moving faster than the air molecules on the lower wing surface. When the molecules move faster over a greater distance, they are more spread out (less dense). When molecules move, they put pressure on whatever they strike. The more molecules that strike the object, the more pressure or force there is on the object. Because there are more air molecules per inch along the bottom of the wing, the pressure of the molecules hitting the bottom of the wing is greater than the pressure from the less dense layer of molecules on the top surface of the wing. This pressure difference causes the wing to be pushed or lifted upward.

Drag: Drag can be considered resistance, or the friction acting on an object moving through air. To reduce drag, you want the surface area of the side of the object that "hits" the air to be as small as possible so the air can flow smoothly around it. Elevators take advantage of drag to help steer the plane. The horizontal tails on full size planes have an elevator that the pilot rotates up to make the plane nose up and fly slower, or down to nose the plane down and speed up. Paper airplanes accomplish the same thing by bending the back edge of the wing up to fly slower, or down to fly faster.

Steering: Changing the angle of the wings (bending them up or down) changes the "dihedral" of the plane. Basically, bending the left wing up veers the plane to the right because the imbalance between the wings alters the lift (way the air molecules flow around the wings), and ends up putting more pressure on the right wing, pushing the plane off to the right. It's similar to how a rudder in a boat works.