



Presents

the

After Class Flight School

A program designed for grades K-6

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Fort Worth Aviation Museum

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FORT WORTH AVIATION MUSEUM

LESSON PLAN:

What students can learn from a paper airplane.

LESSON TOPIC:

Why do paper airplanes fly?

GRADE LEVEL:

Any – with modifications to accommodate age level.

TIME:

25 minutes: Basic Flight Program

50 minutes: Advanced Flight Program

MATERIALS: 8.5 X 11 copy paper, Paper clips, Stapler, Launch source

VOCABULARY: Drag, Gravity, Thrust, Lift, and Aerodynamics

OBJECTIVE:

- After a short lesson on aerodynamics, the instructor will teach students how to create and launch a paper airplane that demonstrates the four forces that affect flight (drag, gravity, lift and thrust).

INTRODUCTION OF LESSON:

The instructor will ask students to respond to several basic aviation questions selected for the appropriate age group.

Sample questions:

1. "We have all seen planes fly. Raise your hand if you have ever flown in a plane?"
2. "Have you ever wondered how a plane can fly through the air?"

At the end of the lesson on flight, the instructor will enable each student to create his or her own paper airplane and launch it. (Pre-built paper airplanes will be available for any age or special education student)

STUDENT CONCEPTS OF FLIGHT:

The instructor will lead students in a brief discussion of why they think airplanes fly, focusing on the four forces of aerodynamics.

PRESENTATION OF AIRCRAFT FLIGHT CONCEPTS:

The instructor will lead students in a discussion of aviation terminology and flight concepts.

Aerodynamics:

Aerodynamics is how easily an airplane moves through the air.

>Student aerodynamic demonstration:

- The students will be asked to hold one of their hands in front of their body with the palm facing sideways so that the thumb is on top and pinkie is facing the floor (like reaching out to shake someone's hand). Have the class swing their hands back and forth. Ask them to notice the amount of air pushing against their hand.
- Now ask the students to turn their palms, so their hands are horizontal and parallel to the floor. Then ask them to swing their hands back and forth, like they are slicing through the air. Ask the students to observe that they will still be able to feel the air, but now their hands are able to move more smoothly than when their hands were positioned the other way.

Drag:

Drag is created when air resists the forward motion of an aircraft.

- Explain to the students that there are many factors that affect the amount of drag created. The shape of the paper airplane is one of those factors. In order to reduce drag and enable the plane to fly as far as possible, the plane must be designed to create as little drag as possible. This will enable the aircraft to move through the air just like the students' hands did when their palms were parallel to the floor.

Gravity:

Gravity is the force that pulls the paper airplane to the ground.

- Tell the students in order to enable a paper airplane to fly as far as possible and help to fight against gravity; their planes must be as light as possible.

> Student gravity demonstration:

- The instructor will have the students put a paper clip on the edge of their unfolded sheet of paper; have them observe how quickly the sheet falls when allowed to drop to the floor. Students will then be instructed to remove the paper clip and repeat the gravity test by allowing the paper to fall to the floor. Students will note how much longer it takes the paper to float back and forth before landing on the floor. Lesson learned: the lighter your paper airplane, the less gravity will pull it to the ground.

Thrust:

Thrust is the forward movement of an aircraft.

- For full sized airplanes, the engine generates thrust. For paper airplanes, thrust is created from the launch of the aircraft by the thrower, or other means of propellant.

Lift:

To overcome gravity aircraft must create an opposing force called "lift."

- Students are told that lift is created when the air below the aircraft wing is pushing up harder than the air above the wing is pushing down. The wings are lifting the aircraft, not the engines (thrust). The wings of the aircraft are usually curved slightly, so that the air can move faster over the top of the wing, than the air moving under the wing. This airflow creates an upward push on the wing, which generates the necessary lift, to stay airborne.

HANDS ON APPLICATION OF THE PRINCIPLES OF AERODYNAMICS:

Construction of student paper airplanes:

- Instructor will demonstrate to the students proper folding of the paper airplane. Instructor will then guide students through the construction of their paper airplanes, utilizing the template provided. Instructor and teacher assistants will oversee this student activity to insure that the paper airplanes are properly folded.

Launch of student paper airplanes:

- Instructor will lead students to a suitable open area. Once formed in a line, instructor will demonstrate the proper throwing motion. Students will be encouraged to start with a smooth throwing motion (similar to throwing a dart). Students will gradually increase their throwing speed (or thrust). Paper airplanes with the larger amounts of wing area (more lift) should stay aloft longer. While sleeker designs with swept wings (less drag) should fly faster and farther.

SUMMARY CLASS DISCUSSION AND QUESTIONING:

Sample questions:

1. Which airplanes flew the farthest distance and why?
2. Which airplanes flew the fastest and why?

CONCLUSION:

The motion of the plane through the air depends on the balancing of drag, gravity, thrust and lift. Aircraft can cruise indefinitely at constant velocity, if the all forces are balanced.

Think about one new thing that you learned in today's lesson.

ADDITIONAL READING MATERIALS:

Blackburn, Ken and Lammers, Jeff. The World Record Paper Airplane Book.

New York: Workman Publishing, 2006

For further information of assistance in implementation of this program contact the Fort Worth Aviation Museum at info@ftwaviation.com or call 855-733-8627.

Happy Flying!