

Topic: Forces of flight, lift

Overview

Students will identify and define the forces of flight, especially lift, and relate the parts of an airplane to these forces as they participate in activities related to the flight video they watch. Each student will then construct, test and evaluate the flight of their own White Wings airplane using on-line resources from NASA. They will explain why it does or does not fly as desired and modify it as needed.

Grades 2-5

Time Allotment

Four to six 60-minute periods

Learning Objectives

On completion of this lesson students will be able to:

- Explain gravity, lift, thrust and drag and how they affect flight
- Name the main parts of a glider plane and what they do
- Adjust his/her glider to make it fly straight

This lesson addresses Va. Science SOL 2.1.


Media Components

- Video: [Bill Nye Science Guy: Atmosphere/Flight \[video\]](#). USA: Disney Educational Productions.
- Television and VCR
- Student computers
- Websites:
 - Plane Math flight website to explore the forces of flight
 1. <http://www.planemath.com/activities/pmenterprises/forces/forces1.html>
Plane math flight website to explore the forces of flight.
 2. <http://www.grc.nasa.gov/WWW/K-12/airplane/yaw.html>
 3. <http://www.grc.nasa.gov/WWW/K-12/airplane/roll.html>
 4. <http://www.grc.nasa.gov/WWW/K-12/airplane/pitch.html>(Note: Sites 2-4 are to view a NASA animation of yaw, roll and pitch.)

Materials and Student Handouts

Per student:

- Airplane Parts Definitions from NASA (use in Activity 2)
<http://www.grc.nasa.gov/WWW/K-12/airplane/airplane.html>
- “How to Make Adjustments on Planes” – using instructions from p 10 and 11 of <http://www.whitewings.com/edu/WWLessonPDF.pdf> (Activity 8)
- White Wings Racer Sky Club instruction sheet that comes as part of the White Wings 30-Plane Competition Kit available from <http://www.whitewings.com/>
- White Wings glider record sheet from p 15
<http://www.whitewings.com/edu/WWLessonPDF.pdf> (for culminating activity)

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- Other supplies to share with each table group of four students: glue, rulers, paper clips, scratch paper, scissors, tape measure, stopwatch

Teacher Preparations

- Prepare lessons using Science of Flight:
www.whitewings.com/edu/WWLessonPDF.pdf
- Enter all websites into flight section of portaportal
- Obtain, preview, and cue video
- Obtain White Wings competition pack
- Punch out the wooden fuselage for each student
- Gather miscellaneous supplies including glue, ruler, paper clips, scratch paper, and scissors
- Make model glider ahead of time to understand the procedure
- Cut a 2"x8" strip of copy paper for each student
- Copy handouts (see student materials)

Introductory Activity

1. Focus: What is flight? Write students responses on the board.

Play: Bill Nye the Science Guy: Atmosphere/ Flight video

Time Cue: 24:00 at the beginning of the flight segment of the video and it flashes the "Flight" title

Stop: Time Cue: 30:30 when it says, "The difference in air pressure, that's where lift comes from," and you see Bill Nye fly away in a paraglider.

Follow up: Using a 2"x8" strip of paper, ask students to predict whether we should blow on the top or the bottom to make the paper go up. Give them time to experiment.

2. Focus: Ask students to demonstrate and explain what happened. Why does it go up when we blow on the top part?

Activity: Discuss how the wind blowing more quickly above the strip of paper makes the air pressure lower on top than on the bottom and therefore the paper rises. Explain that Daniel Bernoulli was a Swiss scientist that discovered this principle long before men were able to make airplanes fly.

Follow-up: What do we call it when our papers go up when we blow on the top? (possible answers to application question: the Bernoulli effect, flight, lift)

Learning Activities

1. Focus: Say: See if you can find out what makes lift happen.

Play: Bill Nye the Science Guy Flight segment of the flight/atmosphere video

Time Cue: 30:30 when it says, "The difference in air pressure- that's where lift comes from," and you see Bill Nye fly away in a paraglider

Stop: Time cue: 32:35 when it says, "This is called the Bernoulli effect, named after the Swiss guy that discovered the principle," and you see a labeled picture of Bernoulli.

Follow-up: Say: What makes lift? Let students give answers.

Draw the side view of an airplane wing on the board.

2. Focus: Draw arrows going straight across the bottom of the wing and around the curved top of the wing. Put two chairs in a line about 10 feet apart and then another chair out to the side about midway between the first two. Ask for 2 volunteers.

Activity: One student walks directly from one chair to the other and the other goes around the 3rd chair to get to the end. Who got to the last chair first? (The person that went straight did). Can you explain why? (The other had farther to go!)

Follow-up: What could be done to get the people there at the same time? (Let them figure out that the person that is curving must go faster.)

Return to the board and discuss how the air must move faster at the top of the wing, just like it did on their strips of paper, so the air pressure is less and higher under the wing, causing the wing to go up.

3. Focus: Give the Airplane Parts Definitions NASA handout (from www.grc.nasa.gov/WWW/K-12/airplane/airplane.html) to the students and ask them to circle everywhere it says LIFT. While they are doing this, hand out the parts of the white wings planes.

Activity: Ask the students to identify which parts of the plane effect lift. The teacher labels the parts the students name on a picture on the board that shows a view of the wing from above. All these parts are on the wing, and you change the shape of the wing by moving them.

Follow-up: Say: What force of flight have we learned today? (lift) What part of the plane causes lift? (the wings) Students write their names on the fuselage of and put their plane parts in their folders for the next time.

Day 2

1. Focus: Now, watch to see how they test airplanes to see if they can fly.

Play: Time cue: 32:25 when it says, “The Bernoulli effect is what makes birds, airplanes and kites fly,” and you see a young girl talking.

Stop: Time cue: 38:03 when it says, “These big ones fly great and they were all tested as models,” and you see a plane taking off.

Follow up: Why do we make models of airplanes? Why is it important to test things with a model? Discuss student responses.

2. Focus: In this segment, we see some other things besides planes that use lift. See if you can identify some of them.

Play: Time cue: 38:04 when it says, “Some people were afraid planes can’t fly,” and you see Bill Nye in front of planes suspended from the ceiling.

Stop: Time cue: 40:13 when it says, “Science is Cool,” and you see a little boy blowing a toilet paper roll horn.

Follow up: Say: What did you see besides planes that have lift? What makes a kite fly? (air, pulling on the sting and running) What makes a plane move forward? (engines, propellers, throwing it) What does air have to do to have lift? (It must be moving.)

3. Focus: Distribute the instructions for the white wings planes. Ask students to tell what the other forces of flight are, they may refer to the paper in front of them.

Activity: Students tell teacher where to draw the arrows on the board to show which

direction each of the four forces of flight causes the plane to go. Ask the following:

Say: What causes the thrust for an airplane? (engines, propellers)

- What will cause the thrust for our glider planes? (we will throw them)
- Which way does the plane go when there is more lift than gravity?(up)
- Which way does a plane go when gravity is stronger than lift? (down)
- Which way does a plane go when there is more thrust than drag? More drag than thrust? A picture on the board of a plane with arrows labeled with the names of the forces of flight greatly helps the students understand this activity. Students this age are easily please and do not expect great art.

Follow-up: Have students complete activities at the plane math website

<http://www.planemath.com/activities/pmenterprises/forces/forces1.html>

Day 3

Review: As the next class begins, ask the students to name the four forces of flight and identify which direction they make the plane go.

Focus: Ask students to take out the “Airplane Parts Definitions” from <http://www.grc.nasa.gov/WWW/K-12/airplane/airplane.html>) and the airplane parts that they put in their folders at the end of the last class. Discuss parts of the airplane using both the kit and the handout

Activity: Construct white wings airplanes as a group using White Wings Racer Sky Club instruction sheet that comes as part of the White Wings 30-Plane Competition Kit Discuss each part of the plane and its function as the planes are constructed.

Follow up: As the teacher names the parts of the plane, each student is to point to the parts on his constructed plane. There is a labeled picture on page one of the instructions. Ask individuals to tell what each part does, referring to the aviation vocabulary section on page one of the instructions if needed.

Day 4

Focus: Now we are going to test our planes to see how well they fly. Ask: What do you think saying that a plane flies well means? (It goes straight; it does not crash, etc.)

Activity: Students try practice flights with their plane and discover that they do not fly straight. As the students test their planes inside, they look at the NASA animations of yaw, roll and pitch on the student computers in the classroom to evaluate the flight of their plane using the website.



<http://www.grc.nasa.gov/WWW/K-12/airplane/yaw.html>

<http://www.grc.nasa.gov/WWW/K-12/airplane/roll.html>

<http://www.grc.nasa.gov/WWW/K-12/airplane/pitch.html>

To make adjustments, students should access instructions from p 10 and 11 of <http://www.whitewings.com/edu/WWLessonPDF.pdf>. Students use proper terms for parts of plane and motions as they adjust their gliders.

Follow-up: Students test planes again to see if they are flying straight and level. They analyze and explain why they are or are not and do further adjustments as needed.

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Culminating Activity

Focus: Today we are going to see how well our planes fly. We will see whose plane flies the longest time and the farthest distance

Activity: Students have a Flight Competition outside to see whose plane flies longest (use a stopwatch for timing) and farthest, record own results.

Follow-up: Students report results which are posted on the chalkboard, each students copies and the group compares results. Discuss which planes flew longer and why.

Assessment

- Teacher observes students. How well do they demonstrate an understanding of parts of the plane and their functions as they modify their planes and justify those modifications?

Community Connections

- A field trip to the local airport would be appropriate during this unit.
- Invite a local pilot to talk to the students about his experiences flying and to show them pictures of his airplanes. A veteran would be a particularly interesting guest speaker.

Cross-Curricular Extensions

History

- Have students explore on-line sites and print resources about Kitty Hawk, North Carolina and Wilbur and Orville Wright and share their findings with the class. I do Kitty Hawk as my landmark of the week while we are doing the flight unit.

Language Art

- The students write a list of the steps of the process of model plane construction.

About the Author

Mrs. Doherty is the Challenge teacher at Elkton Elementary School in Rockingham County, Virginia.

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