

INTRODUCTION

Vultures are large, heavy birds, but they have adapted over millions of years to fly over long distances in order to search for food, all with a little help from rising air currents. Vultures have long, broad wings which makes them very good at gliding and soaring. In order to take off from the ground, they do a run up and flap their large wings to create forward and upward thrust. They only do this until they reach a height where they can ride moving air currents such as mountain winds and thermals. They are not able to fly over vast distances if there is no updraft or air current as they would have to use a lot of energy to flap their wings to keep their heavy bodies aloft.

The vulture uses three main flight methods:

Gliding:

The bird uses no energy and only allows the air to flow over the top of its angled wings to create lift.

Soaring:

The bird uses upward thermal air currents to lift it higher and higher into the air.

Flapping:

This uses the most energy and is usually needed at the lift off and start of the flight. The wings flap up and down to create upward and forward thrust.

AIM AND PURPOSE OF LESSON

The aim of this lesson plan is to introduce students to the dynamics of flight and how vultures are specifically adapted to fly over vast distances in search of food.

DURATION OF LESSON

40 – 75 minutes depending on whether the optional activity is done.

TARGET AGE OF LESSON PLAN

Ages 9 to 12 or Grade 3 to 6

MATERIALS NEEDED

The teacher will need:

1. Lesson Plan 3 – Flight Dynamics of Vultures.
1. A computer with internet connection to view the suggested videos.

2. Video 1: Griffon Vultures Depend on the Sun to Fly. Why? <https://youtu.be/Gt5itallZS4> (1:41 min)
3. Option 1 - Video 2: Easy glider <https://www.youtube.com/watch?v=67Ccf3ejl9U> (2:33 min)
4. Option 2 – Video 3: Paper Airplane Designs A database of paper airplanes with easy to follow folding instructions <http://www.foldnfly.com/#/1-1-1-1-1-1-1-1-2> (1:45 min).
Also print out the instructions available on the website.
5. OPTIONAL: Video 4: Science Maker Foam Glider <http://www.sciencetoymaker.org/airsurf/MamaBug.htm> (7:35 min)
6. OPTIONAL – projector and sound system to watch the video.

The Students will need:

1. Fact Sheet 5 - Vulture Flight Dynamics (downloadable from BirdLife South Africa's website <http://www.birdlife.org.za/documents/bird-of-the-year>)
2. Printed out paper plane instructions from the website <http://www.foldnfly.com/6.html#Hunting-Flight>
3. Paper (to fold a paper glider)
4. Thin A4 sized paper (either from a magazine or tissue paper)
5. Pen and paper
6. OPTIONAL if you are able to make the foam glider in Video 4:
 - a. Foam glider instructions http://www.sciencetoymaker.org/airsurf/pattern/MamaSimpA4_1.PDF and http://www.sciencetoymaker.org/airsurf/pattern/MamaSimpA4_2.PDF
 - b. Clear tape
 - c. Thin wire
 - d. 0.7mm foam sheets
 - e. Ruler

OBJECTIVES AND OUTPUTS

The student will:

- Learn the basic principles of flight and discuss it in class with the help of a simple activity.
- Be guided by the teacher through Fact Sheet 5 - Vulture Flight Dynamics.
- Watch the short BBC video: Griffon Vultures Depend on the Sun to Fly.
- Discuss in the class what they learned from the video and diagram.
- Watch the short video(s) on how to make paper gliders.
- Will make their own paper glider and have a chance to test it out.
- Will have a better understanding of flight in general and specifically how vultures are adapted to fly over vast distances.

VOCABULARY

Air currents: concentrated areas of wind.

Air pressure: the force exerted onto a surface by the weight of the air. Air always flows from a high air pressure to a low air pressure.

Drag: When an object is slowed down or pulled back and moves forward with difficulty.

Draughts: a current of cool air.

Force: strength or energy created by an action.

Glide: Flying smoothly through the air without flapping.

Lift: when air created by low to high air pressure cause an object (wing) to lift.

Primary feathers: the largest flight feathers in a bird's wing located from the mid to the tip of the wing.

Soar: to fly upwards and maintain height without flapping wings.

Surface area: the total outside part of a specific layer.

Thermal: a column of rising air caused by uneven heating of the earth.

Thrust: the force that makes an object move in a direction.

Turbulences: violent or unsteady movement of air or water.

Vortex: a mass of whirling fluid or air.

Weight: the mass of an object which creates a downward force.

PROCEDURE

- [Duration 5 min] Begin the lesson with an entry task. Give each student a thin piece of A4 sized paper. The best paper to use is magazine paper or tissue paper. Let them hold the paper on the short edge and blow over the top of the paper. They will notice that the paper lifts when they do this. Give them the following instructions (instructions and suggested answers in blue):

Take a piece of paper. The best type of papers to use are the thin sheets used in magazines. Hold the short edge of the paper up to your mouth using both hands. What do you think will happen if you blow hard across the top of the paper? Will it go down or up? Now try it.

Ask the students why they think the paper lifted.

Blowing faster-moving air above the paper lowered the air pressure above the paper. Now the air pressure below the paper is higher (air always moves from high pressure to low pressure) and creates lift. Lift does exactly what it sounds like; it lifts objects off the ground when everything is just right.
- [Duration 1:41 min] Set up the projector / TV / Computer and watch the first video: Griffon Vultures Depend on the Sun to Fly (1:41 min).
- [Duration 5 min] Discuss the video with the whole class. Ask them to focus on the following questions (suggested answers in blue):
 - Why do the vultures wait until the sun is warm to fly?

Vultures wait for the sun to heat the ground which creates warm pockets of air that spiral upwards (thermals). The vultures can then use the thermals to fly effortlessly.
 - How are their wings shaped to help them fly?

They have broad, long wings (over 2 meters) that creates the perfect surface to soar and glide on air currents.
- [Duration 5 min] Hand out the printed Fact Sheet 5 - Vulture Flight Dynamics and allow the students 5 minutes to read through it.
- [Duration 2:33 min] Watch Video 2: Easy Glider (2:33 min) or watch Video 3: Paper Airplane Designs (1:45 min) and hand out the printed instruction provided on that website.

6. [Duration 5 min] Give each student an A4 piece of paper and allow them 5 - 10 minutes to fold the paper glider on the video. You can watch the video again if needed. It is advisable for the teacher to practice this folding technique beforehand so that the teacher can help the students to fold it.
7. OPTIONAL [Duration 7:45 min] Watch Video 4: Science Maker Foam Glider.
[Duration 20 min] Hand out the materials needed to make the foam glider and allow the students 20 minutes to build the glider. Assist where needed.
8. [Duration 10 min] Once the students have built their gliders, give them time to play with it. Challenge them to see whose glider glides the furthest.
9. [Duration 5 min] Discuss in class what they have learned from seeing the video, reading Fact Sheet 5 - Vulture Flight Dynamics and playing with their own paper gliders. How does it apply to the way vultures fly? (suggested answer in blue)

The gliders also use thrust (provided by the push or throw of the student) to lift off. The air flows over the top of the glider which provides lift. The forward momentum allows the glider to move in a forward direction for a number of meters. Similarly, vultures run and flap their wings to create forward thrust when they lift off from the ground. After gaining speed and height, they spread their wings to allow the air to flow over the top of their wings to create lift. The vultures however use thermals to gain height more effortlessly, which we didn't see with the paper gliders.