

# **High Flying Lesson Plan**

## **Michigan Curriculum Connections**

**SCI.1.E.1** – Generate questions about the world based on observation.

**SCI.I.1.E.2** – Develop solutions to problems through reasoning, observations, and investigations.

**SCI.I.1.E.3** – Manipulate simple devices, make measurements or scientific investigations.

**SCI.I.1.MS.1** – Generate scientific questions about the world based on observation.

**SCI.I.1.MS.2** – Design and conduct science investigations.

**SCI.I.1.MS.3** – Use tools and equipment appropriate to scientific investigations.

**SCI.II.1.E.1** – Develop an awareness of the need for evidence in making decisions scientifically.

**SCI.II.1.MS.1** – Evaluate the strengths and weaknesses of claims, arguments, or data.

**SCI.II.1.MS.5** – Develop an awareness of and sensitivity to the natural world.

**SCI.IV.3.E.1** – Describe or compare motions of common objects in terms of speed or direction.

**SCI.IV.3.E.1** – Qualitatively describe and compare motion in two dimensions.

**SCI.IV.3.MS.2** – Relate motion of objects to unbalanced forces in two dimensions.

**SCI. IV.3.MS.3** – Describe the non-contact forces exerted by gravity.

## **Time required**

Three 45-minute to 1-hour class periods

## **Classroom materials needed (students work in teams of four)**

- Pilot Logs and pencils
- Variety of pictures of flying birds
- 1 pack of 4x6 index cards and tape
- Paper punch and ruler
- 1 package of straws and large paper clips, straightened
- 1 hair dryer per team
- 1 ball of modeling clay per team
- Access to Internet for wind tunnel site

## **Intrigue**

- Prior to visiting the Air Zoo, visit the website at [www.airzoo.org](http://www.airzoo.org) and preview the exhibit with the students. Review with them what your expectations will be during your visit.
- Distribute Pilot Logs and pencils. Use these to take notes and create drawings and diagrams.
- Ask the students, “Have you ever watched a bird fly high in the sky? Have you ever watched birds flying in formations, diving after things or fighting?” Allow the students to share...then ask if they have ever noticed the shape of bird wings. Draw several shapes based on the children’s observations or ideas.
- Have students get their Pilot Logs where they can make notes and diagrams during their visit. Ask them to look carefully at the shapes of airplane wings. What do they look like from the front, side, and rear? Are all wings the same? Why might they be different?

## **Investigate**

- After returning from your visit, ask students to share their observations of wings. Draw and post them around the classroom.
- Explain that a wing has a special shape that resists gravity and creates the upward force of lift.

- Give each team a 4x6 index card, tape, paper punch, scissors, straw, two metal paper clips, clay, and hair dryer.
- Ask teams to fold the card in half, and slide top portion of card back to show 6mm before taping in place to make a curved upper surface. This is a wing shape...it should not be flat on both sides.
- Direct students to use the paper punch and place two sets of holes side by side in the thickest part of wing. Have kids cut the straw into two 5cm long pieces and put the pieces into the holes of the wing card. Set the wing on the clay base and slip a straightened paper clip through each of the straws into the base.
- Hold hair dryer as steady as possible in one position at a time; use it to move air over the wing to create lift. The wing will climb up the paper clip when air movement creates lift. Ask student to try it on the flat surface of the card and on top. Have them try to fly the wing with the thinnest surface closest to the hairdryer and then the thickest. Ask students to record which position creates the most lift.

### Illustrate

- Air may be invisible and difficult to feel, but it is all around us. It takes up space and has weight. The weight of air pushing down on the Earth is called *air pressure*. Daniel Bernoulli discovered that when air speeds up, its pressure drops. Fast moving air has less pressure than slow moving air.
- Ask students to go to the wing position that climbed highest on the paper clips. The wing should have been higher or thicker closest to the hair dryer and the back of

the wing should be thinner.

Because of this shape, the air sliding over the top of the wing speeds up as it goes and drops in pressure. The higher pressure air below the wing now pushes up on the wing creating lift. Much of a wing's lift is created by this difference in air pressure.

- Lift is the force that pushes an airplane off the ground. Gravity acts on the airplane's weight, pulling it back down. Kites, gliders, and birds have lightweight materials in their structures. That is why the Wright brothers chose light weight wood and cloth when building their flyer. The less weight there was the weaker the force of gravity and the more lift was possible.
- Wings can create lift only if moving through the air. The force that pushes a bird or airplane forward is called thrust. An airplane's propeller gives it thrust just like the forward flapping of a bird's wing.

### Finalize

The Wright brothers did not understand why their larger 1901 wing didn't lift as they expected. To find out why, they built their own wind tunnel and conducted almost 200 tests of different wing shapes. The test showed how air flowed over the airplane wing and what effect the shape had on the amount of lift the airplane could attain. Conduct these same tests.

<http://wright.grc.nasa.gov/airplane/tunlint.html>

## **Assess**

Ask students to draw a wing and describe how it works to lift into the air.