Flight Dreams – The Pressure on Parachutes

Title: The Pressure on Parachutes

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Suggested Grade Levels: It is possible to adapt this lesson to all elementary grade levels.

Subject Areas: Science, language arts

Suggested Length of Class Time: *Section 1:* Air pressure, approximately 30 minutes
Section 2 : Parachutes, 30 minutes-1 hour. Add time for recording observations.

Rationale:
Parachutes afford a simple, familiar, and engaging format for students to gain a basic understanding of the role of air pressure in flight and floating. In a series of experiments, students first explore properties of air pressure. This information can be applied as they then proceed through clear, visual steps that lead to the creation of their own parachutes. (If they have already completed *Flight Factors*, they will have an understanding of gravity). Students will be able to note the role of air pressure in holding the parachute up and gravity in pulling the parachute down.

Logistics:
Classroom Setup: This lesson should be divided into two sessions.

1. *Looking at Air Pressure* has three short segments. Depending on the age of the students, each can be done as whole class, with a partner, or as centre activities.
2. *Parachutes and Air* has two short segments that can be done individually or as a whole class demonstration. The actual parachute construction can be done at a centre with adult assistance for younger students and either individually or working in teams for older students.

Materials: (The quantity that you will need of each depends on whether whole class or individual)

- Two pieces of paper, 22 cm x 3 cm
- One balloon
- Plastic cups
- Drinking glass
- Piece of cardboard
- Paper, can be from recycle bin
- String, or yarn works too
- Weight (cork, toy figure, etc.)
- Scissors
- Tape
- Hole punch
- Variety of materials: plastic bags, cloth, etc.

Suggested resources
Previous lesson plans on flight: "Flight Factors" and "Folding into Flight"

Suggested Outcomes:
Language Arts:

- Explore possible solutions to problems
- Respond to and give simple directions
- Record experiences

Science:

- Identify, solve, and evaluate problems that arise while constructing objects
- Use materials to build objects that move in a specific manner
- Explore movement
- Identify factors that affect movement

Math:

- Develop spatial sense and understanding of position in space

Introduction:
Begin with the questions "What keeps a parachute in the air? Why doesn't it just crash to the ground?" Students can record their hypotheses in individual flight journals, discuss the question in teams, or have a whole group conversation, depending on age and abilities. It is essential that at this stage, students have the opportunity to hear others ideas and that all ideas are recorded as a basis for comparison. After the brainstorming, explain that they will be doing two sets of experiments, (over the time frame that you have established). The first experiments will deal with air pressure, the second with parachutes.

Suggestions for Teaching and Learning:
Lesson #1: Looking at Air Pressure - 20-30 minutes for the three experiments, allowing discussion time for students' observations after each individual experiment. An additional 15 minutes should be allowed for students to record what they have noticed, either individually or as a whole group.

A. *Simple Strips*: This should be done either in teams of two or as a whole class experiment, with one person holding the paper strips and blowing, while the others observe what happens. (If you are holding the strips and blowing yourself, you won't be able to see the result unless you are looking in a mirror. The strips will move together because blowing between the two strips reduces the air pressure)

1. Cut two strips of paper, approximately 22 cm x 3 cm.
2. Hold one strip in each hand, facing each other, about 12 cm apart, **in front of your mouth.** (Your hands will be at the level of your forehead, thus the papers will hang down in front of your mouth)
3. Now, blow **between** these two strips and have your observer (or observers) observe what is happening.

4. Take a moment to discuss what students have noticed and how they would explain the movement. (Flowing air has less pressure than stationary air so the pressure on the outside of the strips is greater than the moving air between the strips and they move in.)

B. *Clinging Cups*: Whether your students are capable of blowing a balloon will determine if this is whole group, teams of two, or a centre activity.
   1. Blow up a balloon about 1/3 of its full size.
   2. Have someone hold two cups (they can be paper, plastic or Styrofoam) against the sides of the balloon.
   3. Finish blowing up the balloon.
   4. Notice what happens. (How many cups can you get to attach—I could only get one, but I'm going to keep trying)
   5. Discuss with the students what happened and why they think it happened (The pressure of the outside air is greater than the air pressure in the cups. This pushes the cups onto the balloon, so they stick.)

C. *Clinging Cardboard*: I would suggest that you do this as a demonstration, unless it's warm enough to be outside with a bucket of water and sun to dry any splashed students.
   1. Fill a drinking glass about ¾ full of water.
   2. Wet the rim of the glass.
   3. Place a piece of cardboard on top of the glass.
   4. Hold the cardboard **tightly** against the top of the glass (no air bubbles).
   5. Turn the glass upside down, carefully.
   6. Now gently let go of the cardboard. (Be sure that you have a basin under the glass when you do this, because if the seal isn't successful, you'll get the glass of water splashing out.)
   7. How many tries does it take?
   8. What happens if you turn the glass sideways?
   9. Discuss with the students, what happened and why. (The pressure of the air against the cardboard is greater than the pressure of the water.)

Conclude with a discussion that connects the three experiments, noticing the power of air pressure and pointing out that movement is caused by the relationship between higher and lower pressure. Record the students' conclusions, either on a chart as a whole group, or in individual journals.

Lesson #2: Parachutes and Air - 30-45 minutes for the first three steps, time for discussion and recording, then as much time as you choose for follow-up parachute construction using different materials and lengths of string.)

A. Drop a Weight: This could be a quick demonstration with whole class discussion of what they notice.
   1. Drop a small weight from a height (as high as you can get, a student standing on a desktop, a balcony or second story window, whatever is available)
   2. Note: how quickly did it fall? Any ideas why?

B. *Crumpled Paper Parachute:* This can also be a demonstration, with prediction and Discussion.
    1. Crumple a sheet of paper.
    2. Cut 4 pieces of string or yard of the same length.
    3. Tape one end of the string (or yarn) to the crumpled paper.
    4. Tape the other end of the string to a weight (plastic toy, cork, etc.)
    5. Drop the paper and weight (from the same height that you dropped the weight in part A).
    6. How quickly did it fall? Was it faster or slower than just the weight? Why?

C. *Flat Paper Parachute:* At this point students can work individually, with partners, in teams of two or more, or, for younger children, in centres with adult assistance.
    1. Cut 4 pieces of string or yarn of equal length (around 40cm works well)
    2. Tape one end of each piece of string to the corner of a piece of paper (8 ½ x 11 works well - can be recycled, if flat and smooth)
    3. Tape the other end to the weight, whatever you are using. (Duct tape works well.)
    4. Have a launch place and drop the parachute and weight.
    5. Observe. How quickly did this fall? How does it compare to the first two experiments? Why?
    6. Record observations and conclusions, either individually or as whole group. The students can draw conclusions about why the parachute falls more slowly when flat paper is used. This will help them make connections with what they learned about air pressure in the first segment of experiments. (*A parachute is affected by two forces - gravity and air. Gravity pulls it down and air resists that pull. The students will be able to conclude which force is stronger, gravity or air. If they have the opportunity to work with the extensions suggested, they will be able to note that the larger the parachute's surface, the greater the air resistance and the slower the fall.)*

Extension of Ideas:

It would be valuable to explore different variables, both in length of string, material for the parachute, shape of parachute, and weight of the object attached. This can be done at a centre, or as a lesson that the whole class undertakes. If you are using plastic, students can cut pieces from kitchen trash bags or plastic grocery bags, recording sizes. They can use tape for attaching string or yarn to corners or they can punch a hole in the corners and tie the string through. If time allows, they can collect data on parachute variables and identify what works best. Interested students can do research in the library or online to learn about the history of parachuting. For example, Leonardo daVinci drew a plan for a parachute that was recently re-created. . They can discover that airplane crews from Canada and Britain weren't allowed to take parachutes with them in World War I, because commanders were afraid they might be tempted to use them and a myriad of other parachute-related history. They can also learn about the concept of "terminal velocity" and the sport of skydiving. Their research can take them in many directions.

Suggestions for Assessment:
Observe students initially as they participate and draw their conclusions. In concluding the experiments, students can be asked, verbally or in writing, to explain the forces that make a parachute float, what materials they would choose to make a parachute float the longest, etc.