EDUC 331
Stacy Stetzel
September 13, 2006

LESSON PLAN by: Meganmarie Pinkerton
Adapted from: Activities for Teaching Science as Inquiry

Lesson: Understanding Bernoulli's Principle **Length**: 20 minutes

Age or Grade Intended: 5th Grade

Academic Standard(s):

5.2.4 Keep a notebook to record observations and be able to distinguish inferences* from actual observations.

5.1.1 Recognize and describe that results of similar scientific investigations may turn out differently because of inconsistencies in methods, materials, and observations*.

5.5.7 Explain that predictions can be based on what is known about the past, assuming that conditions are similar.

Performing Objectives: When given instructions for an experiment, students will explain a logical prediction.

After conducting experiments students will orally explain a logical hypothesis.

After learning about Bernoulli's principle students will explain their experiments connection to the principle.

Advanced Preparation by the Teacher: The teacher will need to make a direction sheet for the experiments for each group with space for them to write predictions, observations and a hypothesis or use worksheets (Straw and Paper, Piece of Paper, Bottle and Paper, and Two Cup). Prepare bags with materials for each group depending on each experiment's requirements. 4 pieces of paper, 4 drinking straws, 2 paper cups, 2-3 pop bottles, paper for paper wads. Copy of The Wright Brothers: How they Invented the Airplane. By Russell Freedman.

Introduction/Motivation: How many of you have heard of the Wright Brothers. I want to start today's lesson by reading to you about their first flight. (read section marked on page 76 in quotations "this flight") Those are words spoken after the first flight. That must have been an amazing experience. How many of you have flown in an airplane before or have seen and airplane in the sky? Well today we are all going to be scientists and investigate the factors that make human flight possible. You will break into groups and conduct an experiment then in the end we will try to figure out how these experiments explain why we can fly.

Step-by-Step Plan:

1. To start the experiment separate students into different groups of two to four students. (Gardner's interpersonal) Explain that they will be working on an experiment in their groups, they need to write group predictions, perform the experiment (Gardner's bodily-kinesthetic), write group observation (Gardner's linguistic and spatial), and a hypothesis (Gardner's logical). At the end each group will present their findings.

2. Next pass out the instruction sheets (Straw and Paper, Piece of Paper, Bottle and Paper, and Two Cups) and materials to each group. Instruct them to begin by following the directions on the papers.
3. Walk around while students are working. Ask; What their prediction is? (Bloom's knowledge), Why they came up with that prediction? (Bloom's knowledge), What happened? (Bloom's knowledge) and Why do you think it happened? (Bloom's comprehension)
4. When students are finished have each group present their experiment, prediction, observation, and why.
5. Explain that all the experiments are connected because of Bernoulli's principle; When air pressure rushes over a surface; the air pressure on that surface is reduced. So the pressure on the other side pushes in the opposite direction. What is the relationship between this principle and flight? (Bloom's analysis) Explain: Draw a picture of a wing on the board showing how air rushes over it. Explain that when it is rounded on the top air has to travel farther so has to travel faster on top to meet the other side, reducing the air pressure on top so there is more pressure coming from the bottom creating lift.

Closure: You were all great scientists today and came up with some great ideas. Now that we understand what helps us fly we will be using our new knowledge for our unit on flight and work on creating different flying projects like paper airplanes and rubber band airplanes. I have many books for you too look at so start thinking about how you can use Bernoulli's principle to build something that will fly.

Adaptations/Enrichment: This lesson involves students working together to come up with ideas. This is good for students with MiMH or LD so they have a chance to talk with their peers and see how others come up with their answers. An adaptation could be that the teacher reviews and gives examples of predicting, observing, and hypothesizing before breaking into groups this way they understand the process better. Also the direction sheets could be more explicit and provide questions to help guide them in their predictions, observations, and hypothesis. An example is; Why did the paper go down in the center? Instead of generically asking why the observed thing happened. This will also help direct students with ADHD in concentrating their thoughts. The teacher could also help direct them by discussing their experiment with them more before they presented to the class to see where their thoughts were going. Enrichments could include deeper investigations about flight or Bernoulli's principle. Students could be given the definition and then have to come up with an experiment to prove that principle. They could also study some of the actual processes that the Wright brothers went through and conduct some of those experiments.

Self-Reflection: How will I know if the lesson was successful?

-If students come up with realistic predictions and hypotheses.

-If students can explain why Bernoulli's principle is important to flight.

-If students enjoy the activity.

How will I assess the lesson?

-Observe students working in their groups to see if they all participate.

-Check work on their hand-out for thoughts, predictions, observations, and hypotheses.

Names:_____

Straw and Paper Experiment

Materials: -A piece of paper
-A drinking straw

Directions: Read experiment instructions. Make a prediction. Do the experiment. Write observations. Come up with a hypothesis, why did this happen.

Experiment Instructions:

1. Get a piece of paper.
2. Make a fold 1 inch wide along one side of the paper. Make another 1 inch fold on the opposite side.
3. Place the paper on a flat surface, with the folds as legs, like a table, to hold the paper up.
4. Put your face level to the paper and use a straw to blow air under the paper.

Prediction: What will happen when you blow air under the paper?

Observation: What happened?

Hypothesis: Why do you think this happened?

Names:_____

Piece of Paper Experiment

Materials: -A piece of paper

Directions: Read experiment instructions. Make a prediction. Do the experiment. Write observations. Come up with a hypothesis, why did this happen.

Experiment Instructions:

1. Get a piece of paper.
2. Hold the piece of paper along the short side with your left hand holding the left corner and your right hand holding the right corner. Let the rest hang down.
3. Put your face level to the paper and blow hard across the top of the paper.

Prediction: What will happen when you blow across the top of the paper?

Observation: What happened?

Hypothesis: Why do you think this happened?

Names:_____

Bottle and Paper Experiment

Materials: -Scraps of paper
-One or two pop or water bottles

Directions: Read experiment instructions. Make a prediction. Do the experiment. Write observations. Come up with a hypothesis, why did this happen.

Experiment Instructions:

1. Wad a small piece of paper so it is about the size of a pea.
2. Lay the bottle on its side.
3. Place the small wad of paper in the opening of the bottle, next to the edge of the opening.
4. Put your face level to the bottle and blow across the opening in front of the bottle.

Prediction: What will happen when you blow across the opening of the bottle?

Observation: What happened?

Hypothesis: Why do you think this happened?

Names:_____

Two Cups Experiment

Materials: -Two small paper cups

Directions: Read experiment instructions. Make a prediction. Do the experiment. Write observations. Come up with a hypothesis, why did this happen.

Experiment Instructions:

1. Place the two cups, tops facing down, on a smooth surface like a desk, make sure there is nothing else on the desk.
2. Place them so there is about an inch of space between the two cups.
3. Put your face level to the desk and blow through the opening between the two cups. Make sure not to blow at one of the cups.

Prediction: What will happen when you blow through the cups?

Observation: What happened?

Hypothesis: Why do you think this happened?