# Lesson Plan: Patang-The Indian Fighter Kite

**Grade Level:** 8

**Subject Area:** Science and Math

**Time Required:** ***Preparation:*** 30 minutes
***Activity:*** 1 hour for kite construction
1 hour for flying kite
2+ days for related wrap-up activities

**National Standards Correlation:**

***Science (Grades 5-8)***

- Science as Inquiry Standard: Abilities necessary to do scientific inquiry.
- Science as Inquiry Standard: Understanding about scientific inquiry.
- Physical Science Standard: Motion and forces.
- Unifying Concepts and Processes Standard: Evidence, models, and explanation.

***Math (Grades 6-8)***

- Measurement Standard: Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Data Analysis and Probability Standard: Formulate questions that can be addressed with data. Collect, organize and display relevant data to answer them.

**Summary:** Using the traditional art of kite making and flying, students will demonstrate the principles of flight.

**Objectives:** Students will:

- Calculate the length of the side of a square.
- Calculate the surface area of the simple plane geometric shapes.
- Calculate the height of the kite using simplified trigonometric functions.
- Organize information in a table format.
- Graph the results of changing the angle of attack.
- Discover and apply the Bernoulli principle.
- Investigate Newton's laws of motion.
- Experiment with the three axes of movement (pitch, yaw, and roll).
- Utilize the lift to drag ratio.
- Record information using the scientific method.
- Use a CAD system on the computer to design a kite.
- Build a fighter kite that flies.
- Calculate the cost of materials to build their kite.
- Practice proper safety habits while building and flying their kite.

**Background:** The fighter kite was invented in India, where they are flown daily from rooftops and during the kite season at large festivals. It is exceptionally maneuverable and capable of flying at amazing speeds with a considerable amount of directional control. It is equipped with cutting devices such as ground glass or porcelain glued to the line below the bridle by means of egg white, rice or other natural adhesives. The U.S. does not use such cutting devices for competitions, and according to the AKA Fighter Committee, the combat rules for the fighter kites include line



Originally published as part of *Project SOAR™: Science in Ohio through Aerospace Resources, Volume I-III.* Dayton, Ohio: The National Museum of the United States Air Force and The Air Force Museum Foundation, Inc. 1997-1999.

touching games, or interacting with objects. Other countries like Japan, Afghanistan, Pakistan, China, and Korea also have a rich background in making and flying the traditional fighter kite with some variations in structure and design.

**Materials:**

Students will need:

- 1 large sheet of tissue paper, 20”x 20”, for the sail
- 1 small piece of tissue paper, 4”x 4”, for kite fin
- 2 hardwood dowel rods, 1/8” in diameter
- Flying line
- Transparent adhesive tape
- Glue
- Scissors
- Ruler, meter or yard stick
- Decorating supplies - markers, water paints, poster paints, crayons, colored pencils, etc.
- Calculator
- Pencil

**Preparation:**

Each group or individual should have at least a square yard of table space and a separate table for supplies and materials. Have precut tissue paper squares and dowel rods available.

**Procedure:**

***A. Warm-up***

Share the information in Background with the class.

***B. Activity***

1. Go through checklist of kite parts. Each student should have a square of tissue paper 20” x 20” for the body of the kite, two dowel rods (one the same length as the diagonal of the square and the other one-fourth the circumference of a circle of radius 20”), and a 4”x 4” square of tissue paper for the tail fin.

2. Have students pre-measure and cut out even strips of adhesive tape and keep them ready on the side of the table for easy access.

3. Apply a line of glue along the diagonal of the square and attach the dowel rod of the same length. Reinforce this bond with adhesive tape.

4. Measure out two pieces of adhesive tape, about 4” in length in readiness for the next step. These will be used to create the wingtip pockets for fitting the other dowel rod.

5. Take one 4” length of tape and attach it to the underside of one of the wingtips with half the width free for step 6. Do the same with the other wingtip.

6. Apply a little glue to the exposed side of the wingtip. Place one end of the second dowel rod along the edge of the glue at the wingtip. Fold the wingtip over the rod and press tightly down on the adhesive tape to seal the dowel rod into the wingtip pocket. Reinforce with more adhesive tape if necessary.

7. Bow the rod across the other dowel rod and fix the other end similarly in the other wingtip pocket, by repeating steps 5 and 6.



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8. Now take the 4” x 4” piece of tissue paper and cut it along the diagonal so that it forms two triangles. Glue one triangle to the underside of the kite for the tail fin. Turn the kite back over and position the two 3” cut dowel rods on the tail fin as shown in the figure. Glue them down. Place the remaining triangle over the other triangle with the dowel rods sandwiched in the middle and glue it firmly down. Reinforce along the edges with adhesive tape. The tail fin is complete.

9. Reinforce all the edges of the kite with adhesive tape. (This step is optional although it is highly recommended).

***C. Bridling the Fighter for Action***

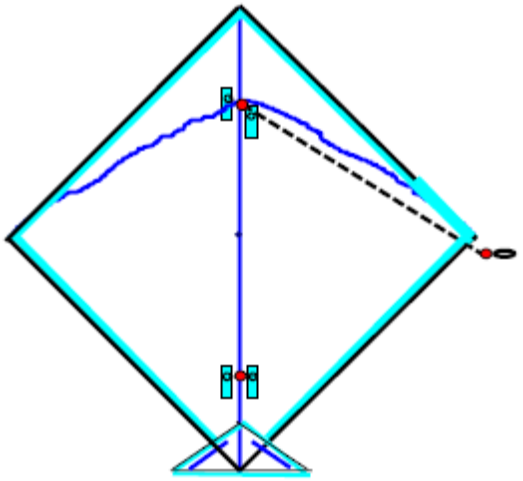
1. The strips represent the adhesive tape.

2. The little circles represent the positions where holes are to be made to insert the flying line to bridle the kite.

3. The dot in the center represents the midpoint of the diagonal. Each dot on the diagonal is equidistant from the midpoint.

4. The dashed line represents the bridle.

5. It is important to remember that the three dots form an equilateral triangle. They also represent the positions where the flying line is to be tied in double knots.



***D. Wrap-up***

Choose wrap-up activities for the class from the list of related activities that follows.

*Related Math Activities**:***

1. Discuss the methods for finding the surface area of geometric objects and find the area of the square.

2. Construct a model showing height from the ground versus angle of inclination from the ground. Have students measure the kite’s angle and calculate height given a standard length of string (Sine Function).

3. Have each student figure out the length of the bowed dowel rod by calculating ¼ of the circumference of a circle of radius 20”.



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4. Have each student construct a clinometer and have the students calculate the height of objects (Tangent Function).

5. Review properties of a square and have students find the constant ratio between the length of the side and the diagonal of a square.

6. Explore various graphing techniques and graph some data from the kite activity.

*Related Science Activities*:

1. Demonstrate and discuss the Bernoulli effect by blowing across the top of a sheet of paper to show the effect. Try the same effect with two hanging ping-pong balls about an inch apart. Blow between them using a straw. The balls should come together. Then show the effect using different styles of airfoils.

2. Talk about the four forces of flight - lift, weight, thrust and drag. Experiment with lift, drag, pitch, roll, and yaw, and compute the force of the kite using a spring balance.

3. Conduct experiments to discover Newton's three laws of motion and how the kite may be affected by them.

*Technology Activities*:

1. Introduce CAD (Computer Aided Drawing) to students. Have them make a two dimensional drawing of a simple object.

2. Have students sketch the kite design based on the information received from their math and science investigations. Then have the student draw this design using the CAD system.

3. Have the student prepare a materials list and cost analysis for his/her design.

4. Have students build and decorate the kite they designed using the materials provided.

5. Discuss proper safety habits for flying kites. Have the students test fly their kites making changes necessary to improve their kite.

**Extensions:**

*Social Studies:* Kite craft is at least two thousand years old. Cover the history of kite flying, the people involved, and the achievements advanced through kite flying.

*Language Arts:* Have students research the etymology of various words related to kite flying. Have them write poems in different styles about making and flying kites. This is also a good activity to have them write research reports about the history of kite flying.

*Foreign Languages and Cultures:* Kite flying is a major activity in India and Japan. Learning about these cultures and language using kites would be an exciting opportunity. Have students contact cities in India and Japan and arrange for contests and interaction of students of both cultures. They could also interview a local Indian or Japanese resident about kite flying in their countries.

*Gifted and Talented:* Students can create new designs, alter existing designs, or even repair old kites as an extension activity.



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**Resources/ References:**


Belsky, Nancy Ann. *Math Project Series - Building Kites, Flying High With Math.* Dale Seymour Publications, 1995.

Gallot, Phillippe. *Fighter Kites: Twenty Original Designs to Make and Fly.* St. Martin's Press, 1990.

Neal, Harry Edward. *The Story of THE KITE.* Vanguard Press, Inc., 1954.

Pelham, David. *The Penguin Book of Kites.* Viking Penguin, 1976.

Cyberfighter Website - Fighter Kites & More. http://www.csun.edu/~hfoao033/fighters.html/#Indian Fighters

Flying Basics For Fighter Kites (An excellent lesson on how to fly your fighter kite step-by-step with illustrations). http://www.fighter-kites.com/newpage2.htm

Gareau - Patang Fighter / BFK - the Kite Store (recent model Patangs can be bought at this site) http://www.kitestore.com/kite97/3995.htm