Introduction to Engineering: Paper Airplane Design

Designed for Grade 9

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Duration
50 minutes

Purpose: To introduce students to engineering design and to have them create an effective paper airplane design given design criteria and a design goal.

Goal: To design the furthest flying paper airplane using only paper, tape, and scissors.

Materials: Paper, masking tape, scissors, and a tape measure

Student Learning Objective:
1. Students will be familiar with how engineers approach design.
2. Students will be able to identify challenges involved with designing an effective paper airplane.
3. Students will be able to discuss the positive and negative aspects of their design.

Introduction:
Students are first given an introduction to engineering design. They are asked what engineers do. Student answers normally are that engineers “build things”, “test things”, “design things”, and “solve problems”. We discuss engineers as problem solvers, and a sample problem is discussed as well as how engineers are responding to that problem. It is also useful to show a short video about this problem (approximately 3 minutes). A good example of a current problem engineers are tackling is the energy crisis.

Next, the concept of design is introduced. We discuss how engineers, when trying to solve a problem, design solutions and then test them to see if they function as expected and fulfill the design goals. The design is then refined and re-tested until all the goals are met. A good and project-relevant example to discuss here is airplane engine design. Discuss how new airplane engines are being designed to be more fuel efficient and environmentally friendly. It is also useful to show a related short video clip here (approximately 3-5 minutes).

Project:
Students are challenged to design a paper airplane that flies further than the airplanes designed by their classmates using only paper, tape, and scissors. They are encouraged to think creatively and take into account the challenges that come with designing a paper airplane that will stay airborne for extended period of time. Such challenges are balancing the weight of the airplane so that it does not spin and providing enough wing surface area (but not too much) so that proper lift can be achieved. Students
are allowed five test flights of their design prior to the contest. All test flights must occur in a designated test area in the classroom. Students are encouraged to improve upon their design after their test flights and to fix any problems that they may notice. After the students are given 15-20 minutes to design and test their airplanes, the contest begins. The contest may occur in a designated area of the classroom free of obstructions, or in a hallway. One at a time, the students throw their airplanes forward from a designated starting line. The landing spot is marked and the distance is measured with a tape measure and recorded. Each student may be allowed two flights. The winner of the contest is the student whose plane covered the most distance before landing.

**Follow-Up Discussion:**
Students are asked what they believed the biggest challenges in designing a paper airplane were. Good answers include balancing the weight of the airplane so that it does not spin and providing enough wing surface area (but not too much) so that proper lift can be achieved. Similarly, they are asked what about their specific design they thought was a good idea and what ideas did not turn out as they expected. The discussion is concluded by discussing how engineers use the same approach to test their proposed designs and how final engineering solutions are the result of much testing and alteration of the initial design.

**Assessment:**
1. Was the student creative in the design of their airplane?
2. Was the student’s design effective?
3. Did the student follow the rules regarding the use of materials?
4. Did the student follow the rules regarding the location and number of test flights?
5. Was the student able to discuss the positive and negative aspects of his/her design after the contest?