**Skimmer Car Design Challenge**

Angelica Horvath, Adrienne Lockhart, & Courtney Reynolds

Professional Development at Buffalo State College: Attendees from B.P.S. Harriet Ross Tubman School #31

---

**Contextual Scenario**

In today’s competitive economy, companies are always looking for an advantage. No where is this truer than in the automotive industry. Car companies work hard to design the next best car, and to beat out the competition. As such, there is always a need for engineers who understand how to problem-solve, in a real-world way, in order to improve upon existing designs. To do this, engineers must understand how each part works, and how making changes to each of those parts will affect the whole. It is also necessary to understand the final goals of the process; whether that be speed, distance, accuracy, aesthetics, or some other need.

**Design Challenge**

Your challenge is to construct your own skimmer car with your group that can go a long distance using only the materials you have been provided. After you and your group construct your car, test the car using the launcher provider to determine how far it will go. Measure the distance your car traveled. Later, you will have opportunities to construct and alter new cars. We will have a competition for the best performance car and awards for different design categories.

**Objective**

Students will be able to use the engineering design process to create a skimmer car to demonstrate the science concepts of lift, thrust, drag, and weight. Students will be able to conduct numerous trials in order to improve the distance of their skimmer car.

**Standards**

Next Generation Science Standards:

1. 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
2. 3-PS2-2 Make observations and predictions of an object's motion to provide evidence that a pattern can be used to predict future motion.

**Disciplinary Core Ideas:**

PS2.A Forces and Motion
- Each force acts on a particular object.
- Each force has both strength and direction.
- The patterns of an object's motion in various situations can be observed and measured to help solve the problem of its behavior.

PS2.B Types of Interactions
- In contact forces act on each other.

**Science and Engineering Practices:**

1. Asking Questions and Defining Problems: In grades 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships.
2. Planning and Carrying Out Investigations: By asking questions that can be investigated based on patterns such as cause and effect relationships.
3. Developing and Using Models: By defining a simple problem that can be solved through the development of a new or improved object or tool.
4. Analyzing and Interpreting Data: By planning and conducting an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

**Materials**

- Card stock (various weights of paper for later trials)
- Brads
- Scissors
- Tape
- Rulers
- Measuring tape
- Rubber bands
- Wooden boards
- Nails
- Hammer
- Pencils
- Charms
- Stopwatch (optional)
- Journals (optional)

**Procedures**

1. Students will be introduced to a model of a skimmer car. They will discuss the parts and function of the parts. Students will review pre-taught vocabulary of drag, lift, thrust, weight.

2. Students will be placed in teacher chosen groups. Depending on age and skill level students will either draw and measure plans to scale using a ruler for measurement, or measure pre-drawn plans and record measurements for future alterations. Students will then cut out parts of the car.

3. Students will then cut, fold and assemble their car.

4. Student will use a rubber band attached to a wooden block to "propel" their skimmer cars. Students will then measure and record distance on their chart.

5. Student will compare their car’s performance and discuss possible alterations to improve performance.

**Concepts**

- The teacher will pre-teach a lesson on measurement. The teacher will teach measuring to the inch, 1/2 inch, 1/4 inch and 1/8 inch to students.
- The teacher will frontload the vocabulary words drag, thrust, weight, and lift. Teacher will use videos, textbooks, and other resources to provide vocabulary instruction. Sample videos may be found in the reference section of this poster.

**Strategies**

- The teacher should blow up the elementary design process on bigger poster paper, and discuss each step with the children as they go through it. They should discuss why each one is important, and why it is so important to go back and work on improving your invention.
- The teacher should be doing mini lessons within the bigger lesson one on measurement.
- Working with the social studies curriculum teaching the students about the history of the automobile, and learn about local businesses in the area that make automobiles.
- Working on lessons on graphing and charting data that is collected while conducting their many trials.
- In ELA working on journaling results of the trials, and writing a formal letter to local businesses to learn about how an automobile works.

**Conclusion**

By engaging in this engineering design challenge students will have the experience of applying science and math concepts to an engaging hands on design exploration that results in the completion of a skimmer car model. Students will also have the opportunity to further explore problem solving through repeated alterations and testing of various skimmer car models. Students will use cross curricula skills in ELA and Social Studies to deepen their understanding of Science and Math concepts.

**Extensions**

- Older students may try for speed as well as distance using a stopwatch.
- ELA journaling and prompting may be used to reflect on performance and plans for future alterations.
- Possible homework may include sending home a pre-cut skimmer car home with students for them to construct with family members. Cars will be brought back and tested in school.
- Skimmer cars will be used as an activity station for school Community Night where students will teach other students and parents how to engineer and test their car.
- Students will exhibit their best skimmer car in school's display case and share science concepts behind their successful cars.
- Students will connect their skimmer car learning to the Social Studies curriculum by learning about the history and progression of cars and their ties to Buffalo through the Ford and GM plants.
- Students will send letters to the local Ford and GM plants exploring the science and math behind their skimmer cars.

**References**

http://video.pbs.org/video/1607925512/
http://www.sciencedkids.co.nz/videos/engineering/flighthaerodynamics.html