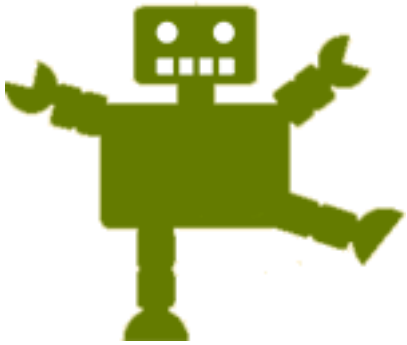
SCIENTIFIC AMERICAN FRONTIERS

TEACHING GUIDE

Activity 4: Grades 5-8

Robo Wars



In this segment of Scientific American Frontiers, you observed one of the yearly robot competitions at the Massachusetts Institute of Technology (MIT). In the competition, machines face off on a balance beam. The machine that successfully brings its side of the balance beam down - by whatever means necessary - wins. The constraints: All students are given identical boxes of parts out of which to build their machines, which must not exceed ten pounds and must fit back into the box when completed.

This activity page will offer:

- An opportunity for creative design
- An activity using self-powered vehicles
- A classroom challenge in testing, design, and construction

Ramp-climbing Competition

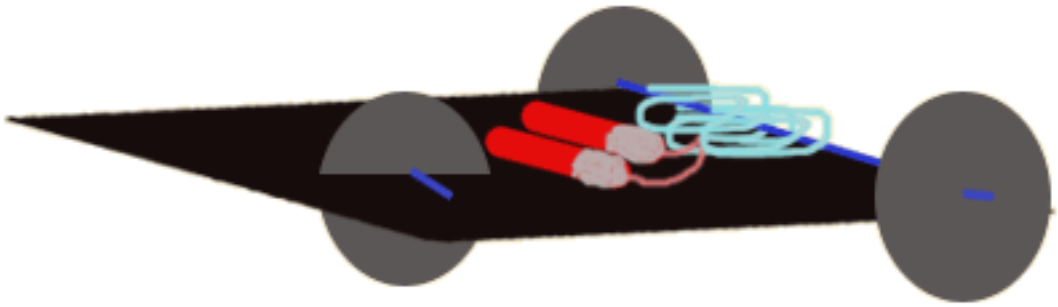
Are you ready for a challenge? In this activity, you'll be placed into groups and given a kit of construction supplies. The supplies include a variety of simple building materials and a DC motor with a power source. Your group's role is to use these parts to assemble a motor-powered vehicle that can climb up the steepest ramp angle.

Materials (Per Kit)

- DC motor
- AA cells with holder
- Connecting wire
- 2 plastic straws
- 4 paper clips
- 4 rubber bands
- 4 paper fasteners
- Sheet of heavy-stock cardboard
- Scissors
- Tape
- Paper
- Ramp (consisting of a wooden plank support by a stack of books)

Steps

1. Work in a cooperative team as designated by your instructor. Your team's challenge is to create a self-powered vehicle that can climb ramps of different angles.
2. Obtain the team material kit. Remove each of the parts and discuss how each might be used in the construction of a self-powered vehicle.
3. Brainstorm all elements of the vehicle's design. Consider things such as the number and placement of wheels. Consider the overall chassis design as it relates to the placement of the motor.
4. Once you have decided on a prototype design, sketch out a blueprint for your vehicle. Label each part. Share your blueprints with other members of the class and discuss your design strategy.
5. With your instructor's approval, assemble your vehicle according to the submitted plans. Use care when using scissors or other sharp objects.
6. Test your design. Think of ways to improve the vehicle's performance using any leftover materials from your materials kit. Test and evaluate your improvement designs.
7. In the classroom challenge, compare your vehicle's performance in climbing ramps with the performance of other vehicles. Which one can climb the steepest ramp? Which one is quickest? Examine the factors that account for the observed differences. Use your observations to continually improve your vehicle's design.
8. Test your final designs. What improvements did you make? Why were they successful in improving performance?



Questions

1. What construction parts accounted for most of the vehicle's mass?
2. How did the placement of the motor affect the vehicle's directional stability and traction?
3. Did the wheels affect the climbing ability of the vehicle? Explain.

Robotic Interview

Work with a group of students to compose a humorous play in which the main characters are a crew of robot television hosts. These hosts present a show that addresses topics of concern to their robot audiences. If applicable, model the show's structure on similar daytime television offerings such as The View or The Other Half. Consider different guests or features that might be the focus of a segment. After writing the script, perform it for your classmates.

And the Next Competition Is.... Suppose you were in charge of designing competitions for classroom robotic creations. What types of competitions would you create? What factors might influence your choice? How might the competitions be crafted in order to attract a broad television audience?

Future Shock

Write a science fiction story about a group of engineering students participating in a robot competition. Unbeknownst to the students, the robots have a sinister intelligence. Secretly the robots communicate with each other as they plan to overthrow the humans and take over the campus.

Web Connection

Robotics Education Project

http://robotics.nasa.gov/matrix.htm
NASA site on robotics and classroom activities.

Robot Competition FAQ

http://www.robots.net/rcfaq.html
A list and description of robot competitions around the world

The History of Robotics

http://www.faculty.ucr.edu/~currie/roboadam.htm
Well-illustrated history of robotics with many links to additional resources.

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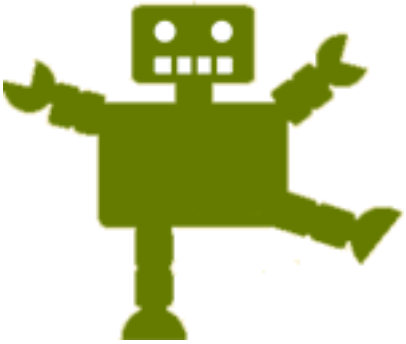

Questions

1. What construction parts accounted for most of the vehicle's mass?
   (The motor and cells)
2. How did the placement of the motor affect the vehicle's directional stability and traction?
   (Motors placed at the rear usually produced a vehicle that had more traction and stability)
3. Did the wheels affect the climbing ability of the vehicle? Explain.
   (Yes. Wheels that had rough surfaces produced more traction and were able to climb steeper ramps.)

CURRICULUM LINKS

Physical Science :

Force

Friction

Mass

Scale

Technology :

Design process

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Physical Science - Content Standard B

Students will investigate forces and motion.

Science and Technology - Content Standard E

Students will consider design proposals based on select criteria of purpose.

Students will communicate design ideas through scale drawings.

Students will evaluate designs based on criteria and propose modifications for improvement.