Robotic Arm Challenge

This lesson was adapted from the lesson "Robot Arm" Developed by IEEE as part of the IEEE Teacher In-Service Program www.ieee.org/organizations/eab/precollege

Title of lesson: Robotic Arm

Grade level: 4 and up

*appropriate for ages 10-99

Science content statement addressed:

Motion and Force
Transfer of energy
Interaction of energy and matter

Technology Literacy

Influence of technology on history
Engineering Design

Overview: Working in teams of 3-4 students are provided with materials listed below. It could be available in a Makerspace, or set out at tables. Groups could collect them from a central location and bring them back to table.

Each group will use these materials and only these materials to create a robot arm. The robotic arm must be a minimum of 18 inches and be able to pick up an empty styrofoam cup.

Maker Materials-

3" wide and approx. 22" long strips of cardboard
5 or so Binder clips (different sizes)-- 8 or more
Brads-- @10
Clothespins-- 6
Craft sticks--10-15
Fishing line-- 3-4 feet
Hangers-- 1 or 2
Paper clips (diff. Sizes)-- 10-15
Pencils-- 3-4
Rubber bands (different sizes)--15
Tape-- clear and masking (partial rolls should be fine)
Twine-- 3-4 feet
Various size scraps of cardboard--10 assorted

Additional Materials

For each group for design process
Clipboard, Pencils, Paper

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Optional Materials/Resources

This is a great film clip to have on hand. When students get this assignment typically students will get a bit frustrated or feel that this just can't be done without some type of modern technology.

Show this clip when they hit that point or right before they begin this project. Share with them that this is a true story, and it was this ingenuity that saved the astronauts life. They could ONLY use the materials they had, much like this assignment.

"Square Peg into a Round Hole" from Apollo 13
https://youtu.be/1cYzkyXp0jg

Procedure:

Using the materials provided groups will design and build a working robot arm. Groups are not required to use all materials.

The robot arm must be at least 18 inches in length and be able to pick up an empty Styrofoam cup or other light object.

Groups will design and agree on a design.

Groups must have a sketch of their design and list the materials they will be using prior to creating their prototype.

Time should be allotted for "beta" testing and making any adjustments deemed necessary.

Changes should be documented on their design sketch.

A clear time frame must be determined by the teacher.. When that time frame has been reached students must stop whether they feel they are done or not. (Deadline practice)

Groups share with class their design, reasoning, and then test/demonstrate their prototype. If they were unable to complete their arm they should describe why they felt their design will work upon completion.

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Extension

Create a digital presentation, movie, or time lapse documenting the activity. Students should identify the engineering or design steps that you use in your curriculum.

Post-Project Classroom Discussion/Activities

Did you use all the materials provided to you? Why, or why not?

- Which item was most critical to your robot arm design?
- How did working as a team of four help in the design process?
- Were there any drawbacks to designing as a team?
- What did you learn from the designs developed by other teams?
- Name three industries that make use of robots in manufacturing: