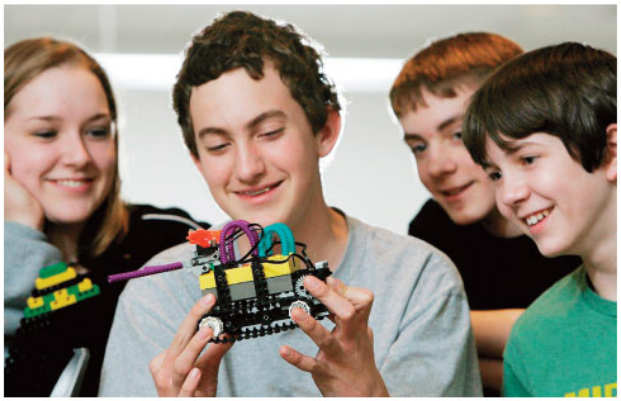
4-H ROBOTICS

Year-Round Training Guide

MODULE 7:

An Experiential Model of Building Robots

4-H Robotics: Engineering for Today and Tomorrow



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4-H Robotics Curriculum

4-H Robotics Introduces Youth to:

- Basic physical science concepts related to robotic systems
- The Scientific Inquiry Process
- The Engineering Design Process
- Technology tools for learning and communications
- An exploration of SET careers

4-H Robotics Curriculum

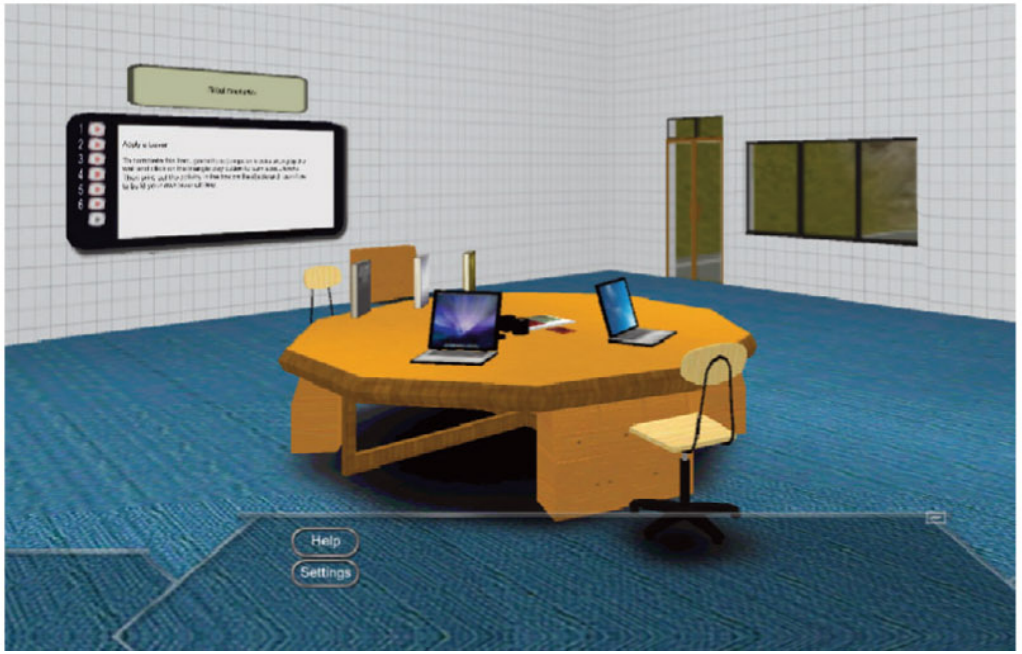
- ***Virtual Robotics:*** Youth utilize an interactive computer game environment to learn about the science and engineering of robots.
- ***Junk Drawer Robotics:*** Youth make use of everyday objects to design, build and learn about robots.
- ***Robotics Platforms:*** Youth employ robotics kits to understand robotics and programming and develop their own robot designs.

Track 1: Virtual Robotics

Youth build skills and knowledge about robotics as they play an interactive computer game.

The learning experience includes videos, simulations, and animations—all in an interactive virtual robotics lab.

Curriculum is delivered on a DVD.



MODULE 7: **An Experiential Model of Building Robots**

4-H ROBOTICS

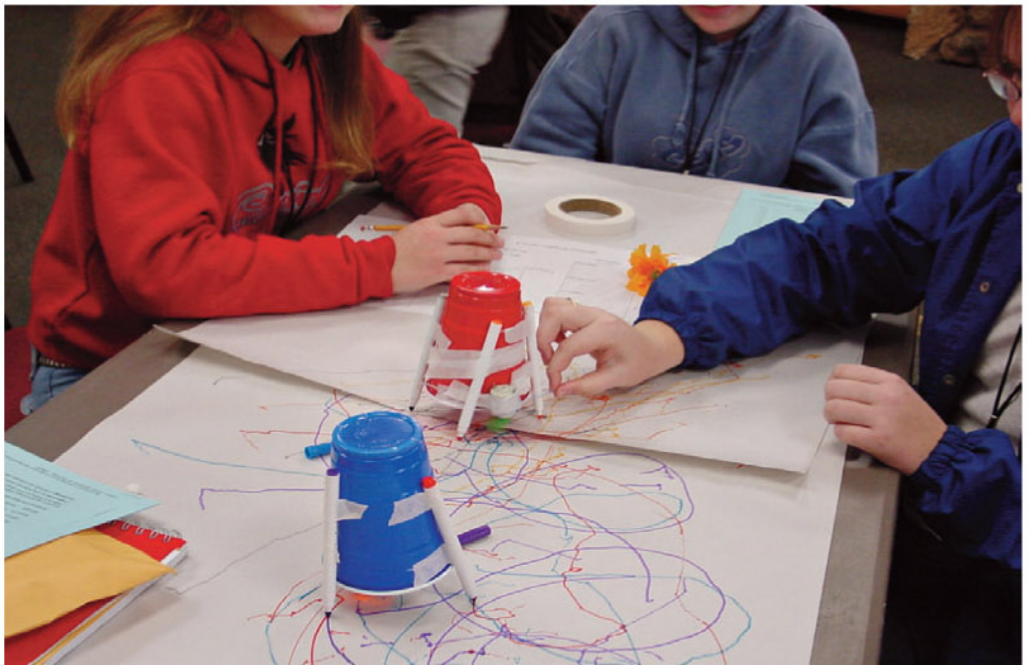
Track 2: *Junk Drawer Robotics*

Youth design, construct and test robots that lift, move or float.

Each level focuses on one aspect of robotics and the science, engineering and technology behind it.

Designed to be a teen-led program.

Curriculum includes three printed presenter's guides and a youth Robotics Notebook.



MODULE 7: **An Experiential Model of Building Robots**

4-H ROBOTICS

Track 3: Robotics Platforms

Youth apply the engineering processes of designing, building and programming robots.

Youth build skills and knowledge and apply what they have learned to a challenge activity.

Curriculum is delivered on a DVD.

Makes use of a commercial robotic kit such as LEGO® MINDSTORMS®, VEX®, TETRIX® or CEENBoT™.

LEGO® Robotics Kits

NXT Robots

RCX (1998) Brick

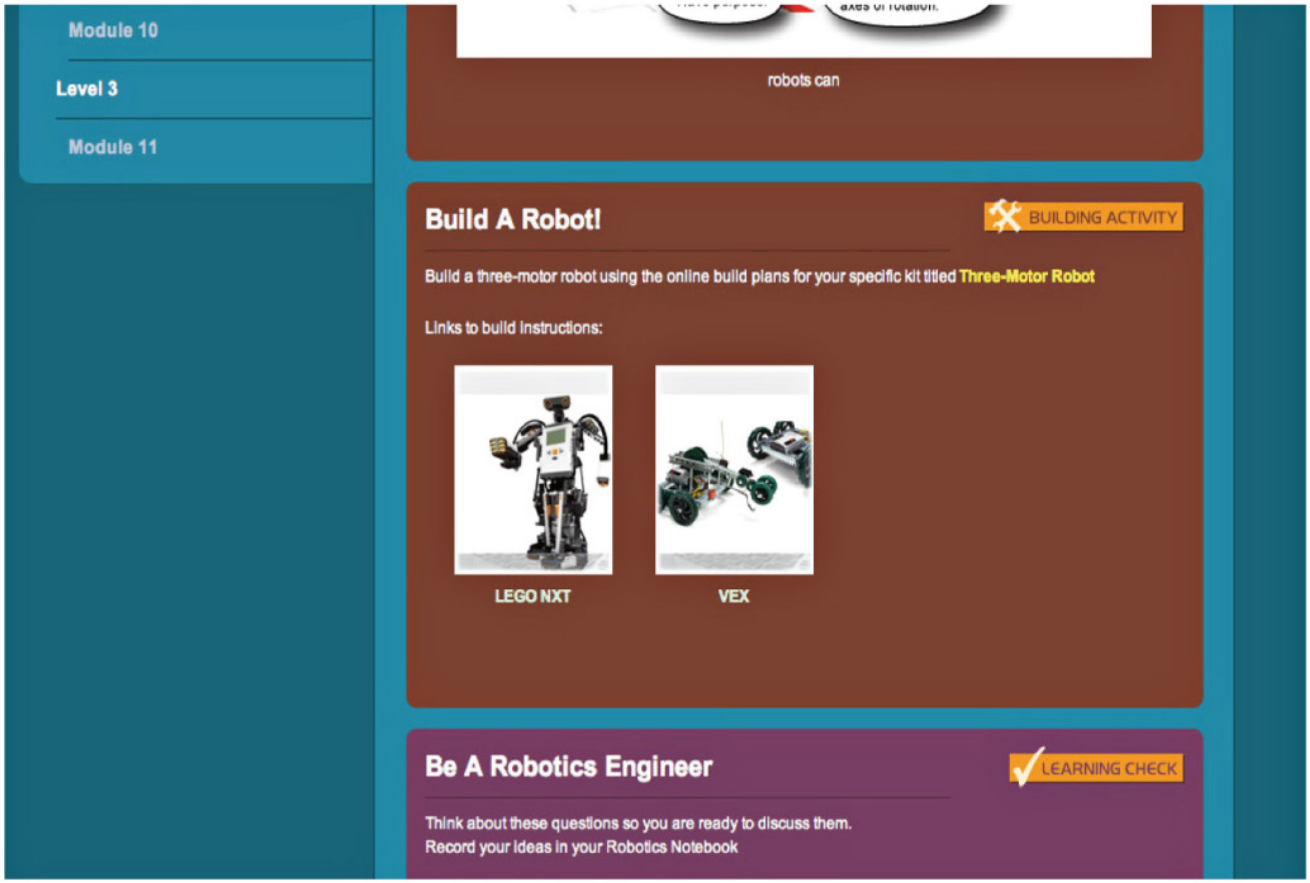
NXT (2006) Kit

EV3 (2013) Kit

Robotics Platforms

Build a Robot!

Module 1, Page 3

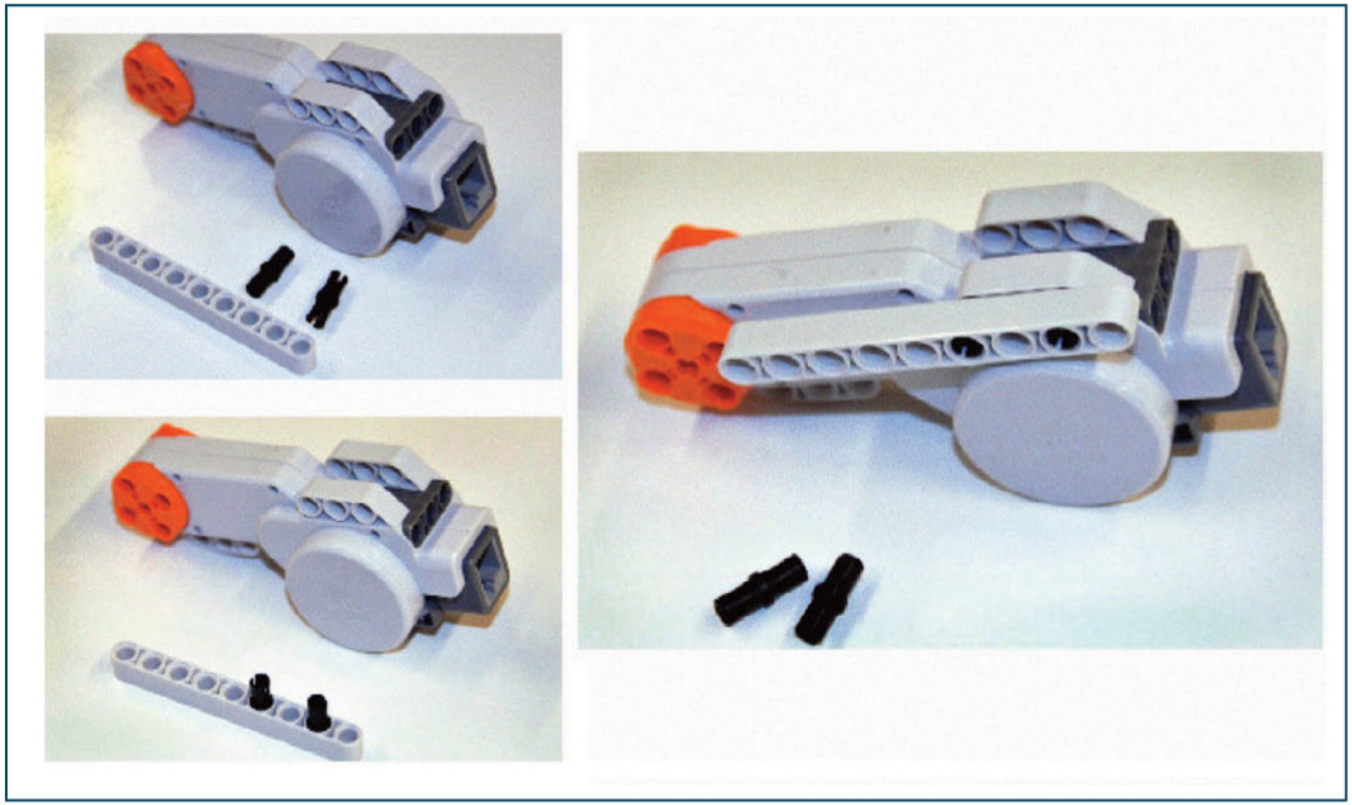


Cow-Bot

Build Plans for Cow-Bot

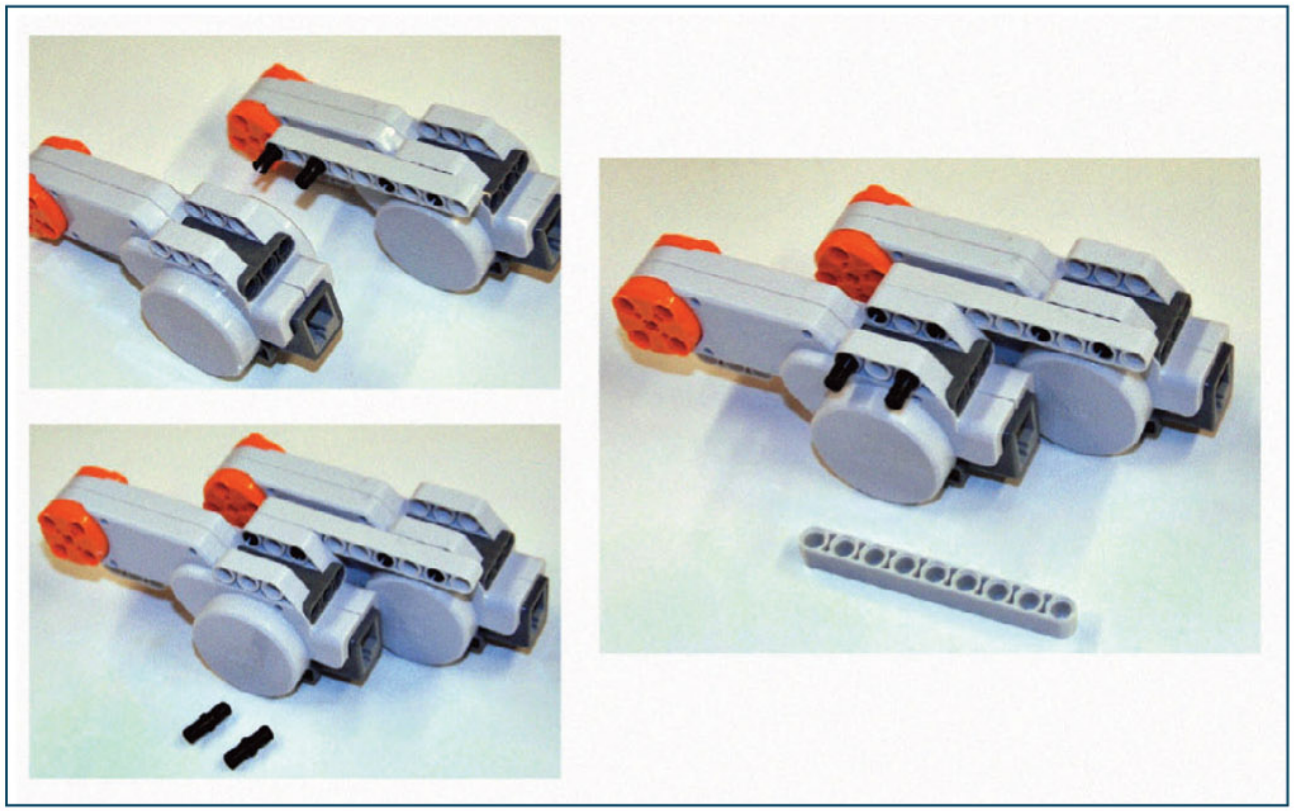
October 2009

Cow-Bot- 2



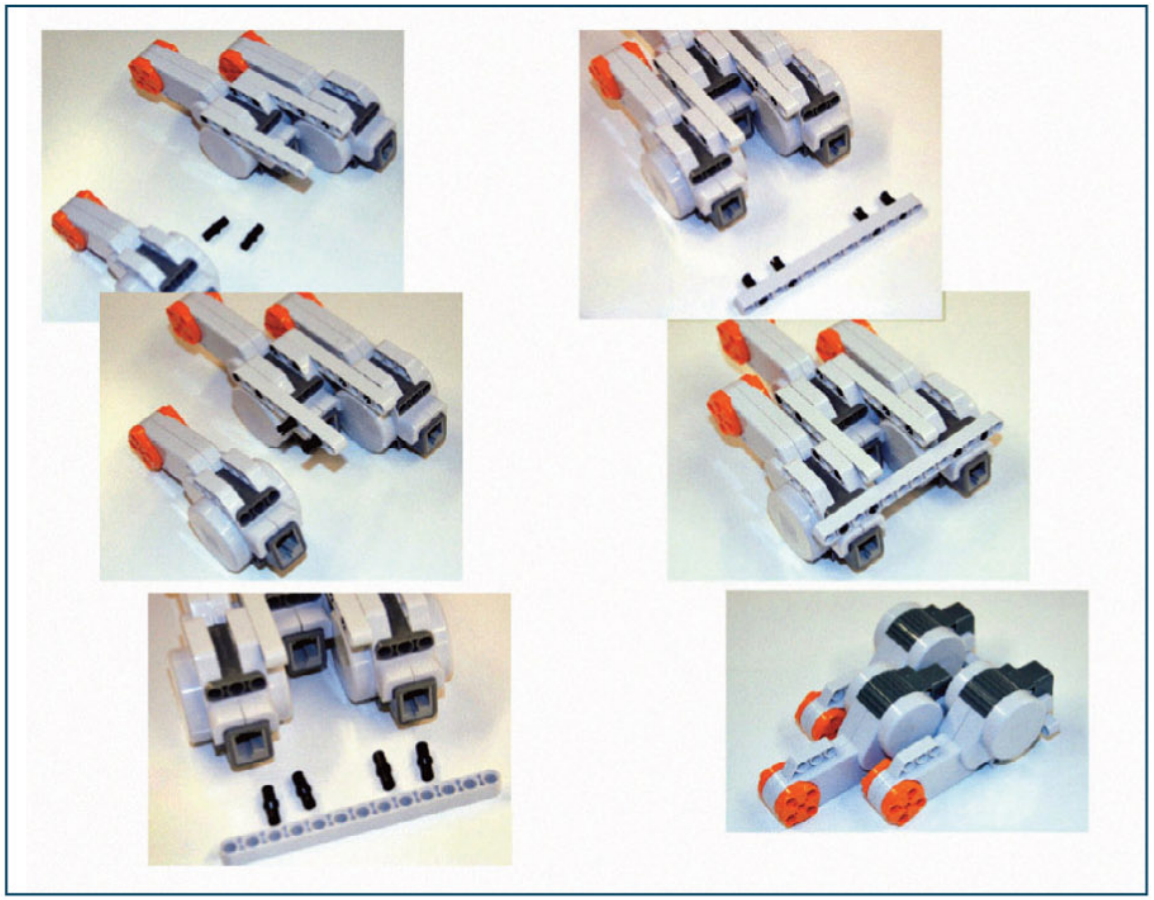
Build the Wheel Base

Cow-Bot- 3



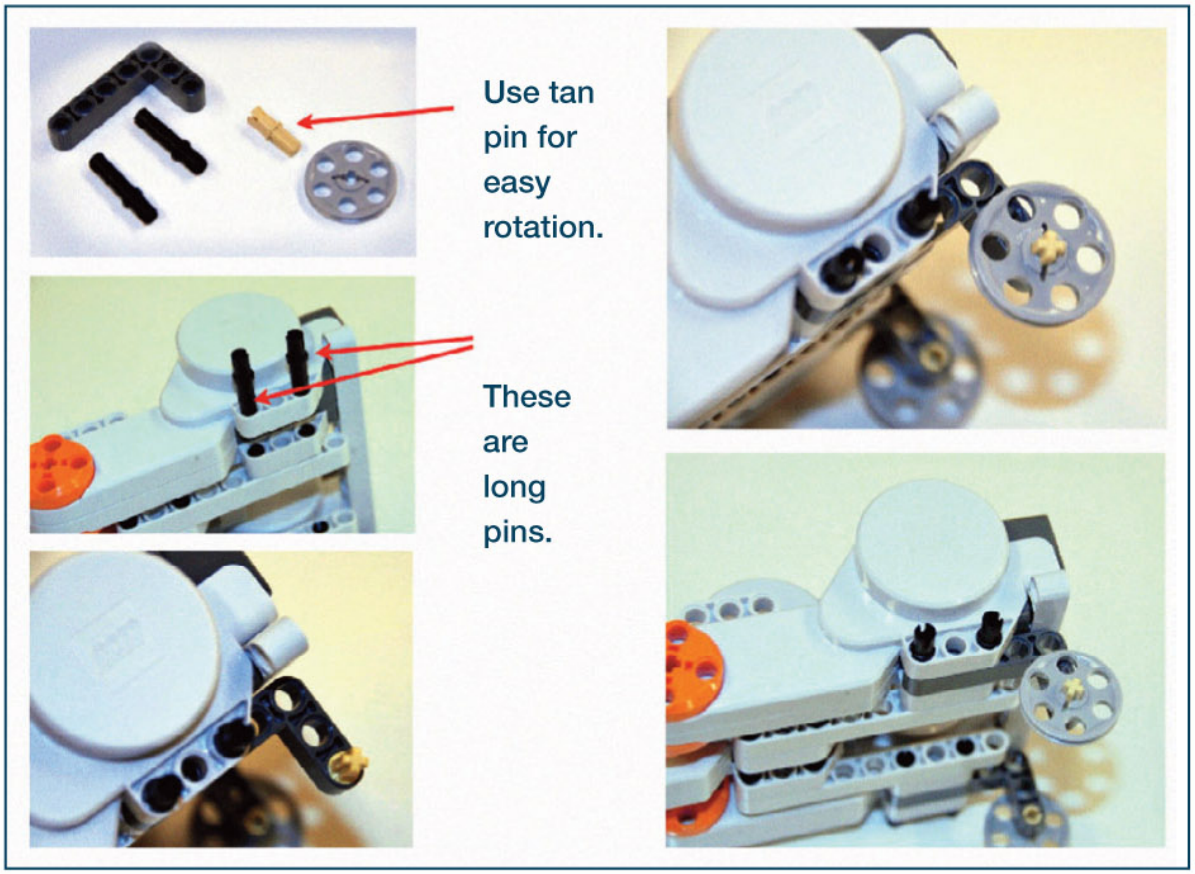
Build the Wheel Base

Cow-Bot- 4



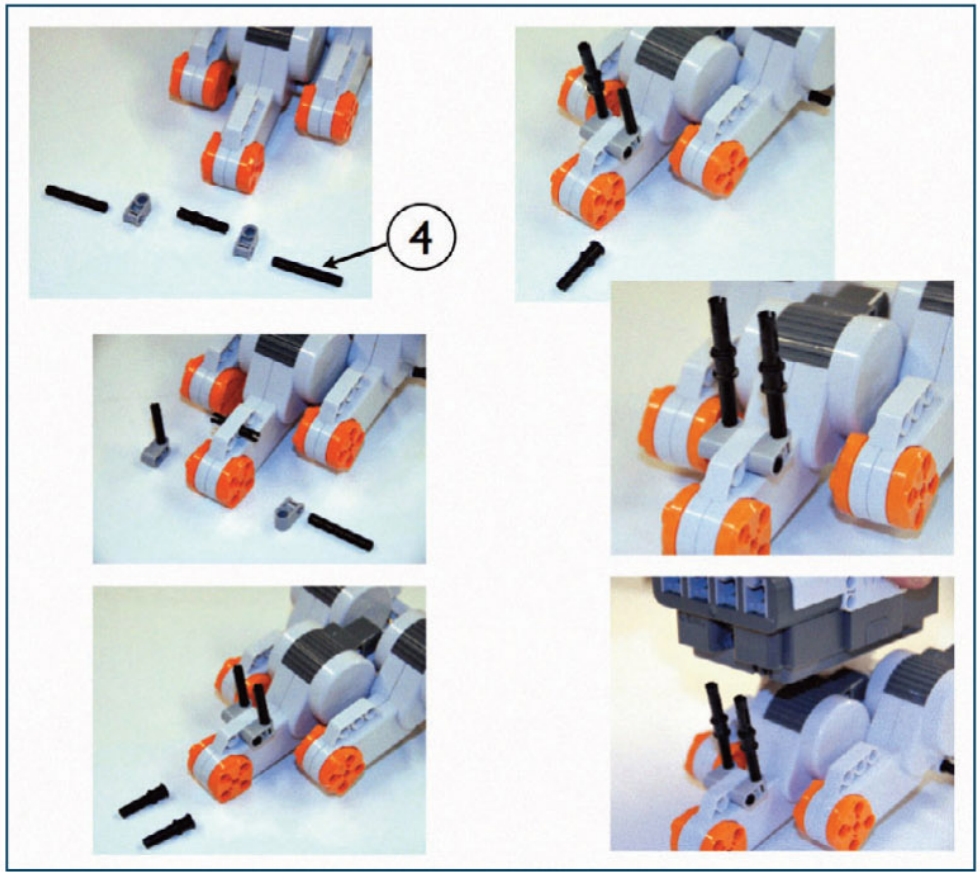
Build the Wheel Base (continued)

Cow-Bot- 5



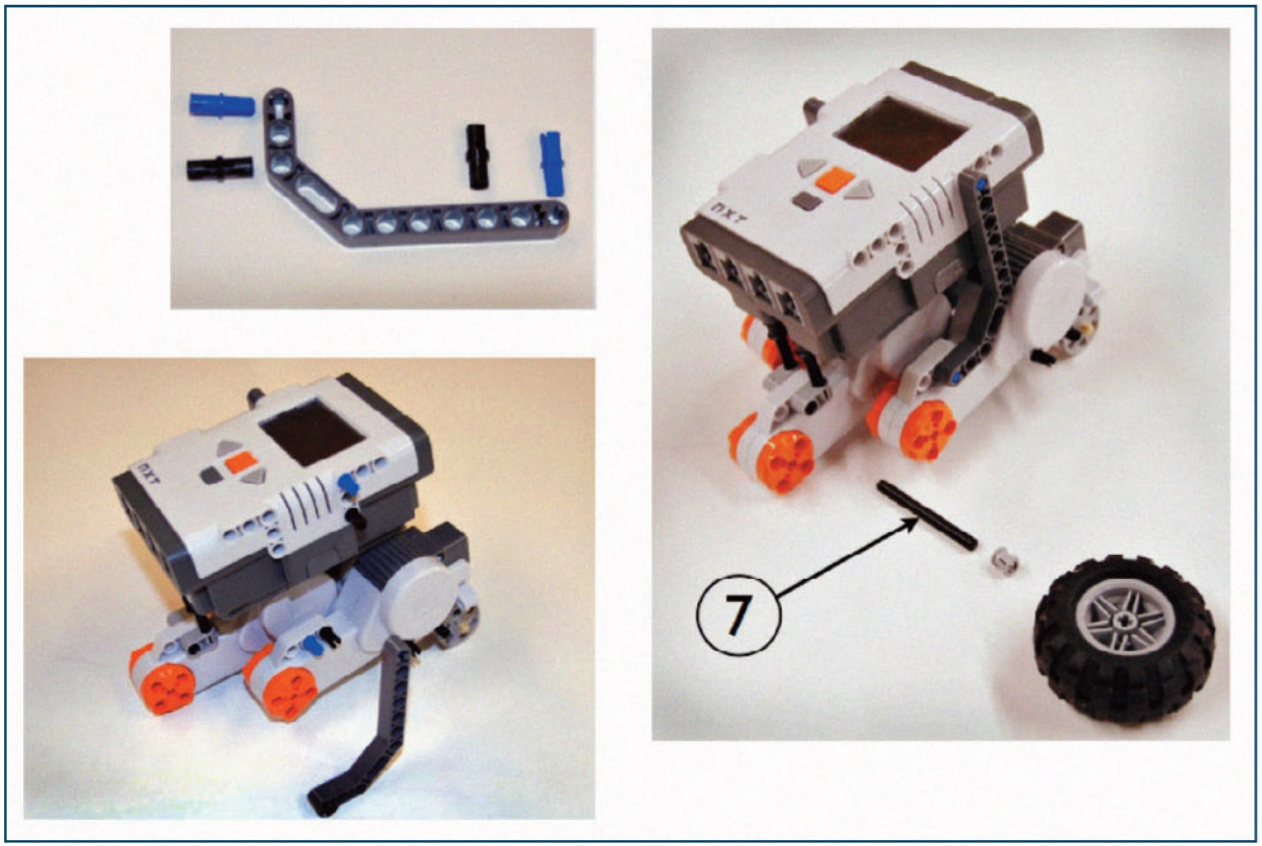
Add Rear Wheels

Cow-Bot- 6



Mount NXT Brick

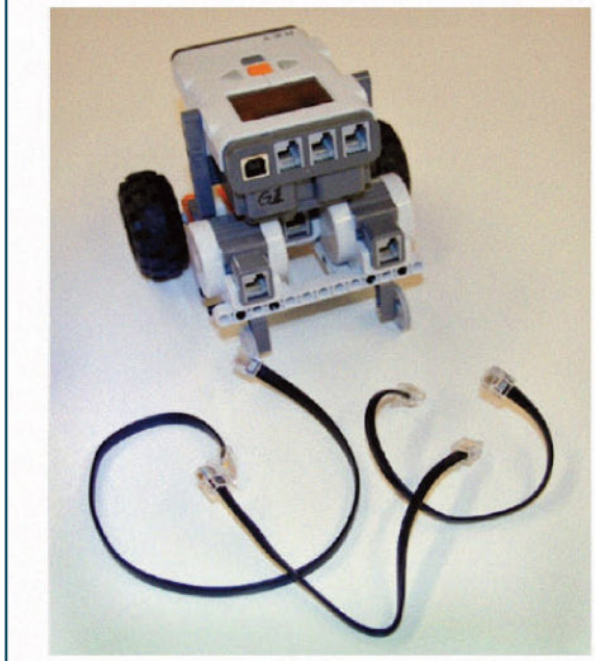
Cow-Bot- 7

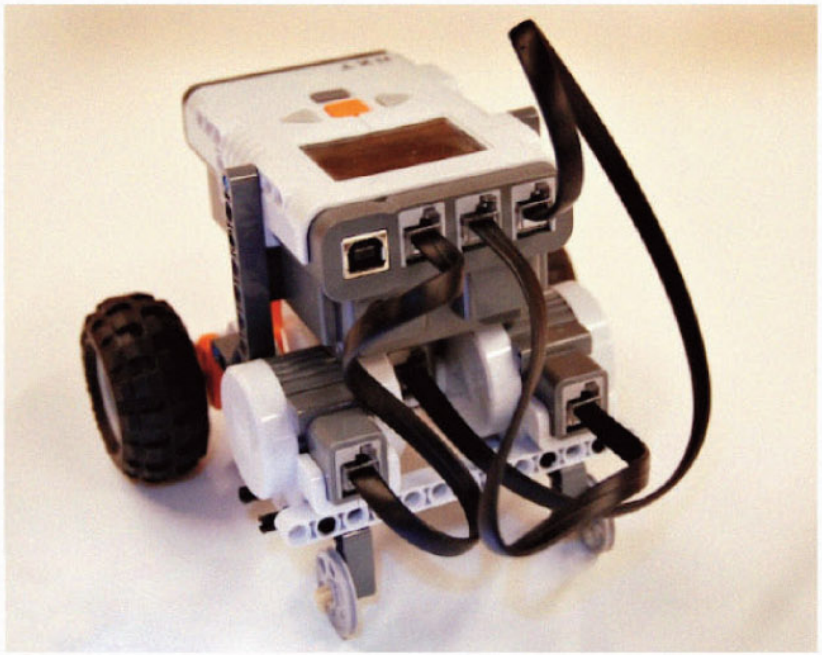


Mount an axle, inner nut and wheel on each left and right motor (we will use the middle motor later).

Mount NXT Brick and Drive Wheels

Cow-Bot- 8





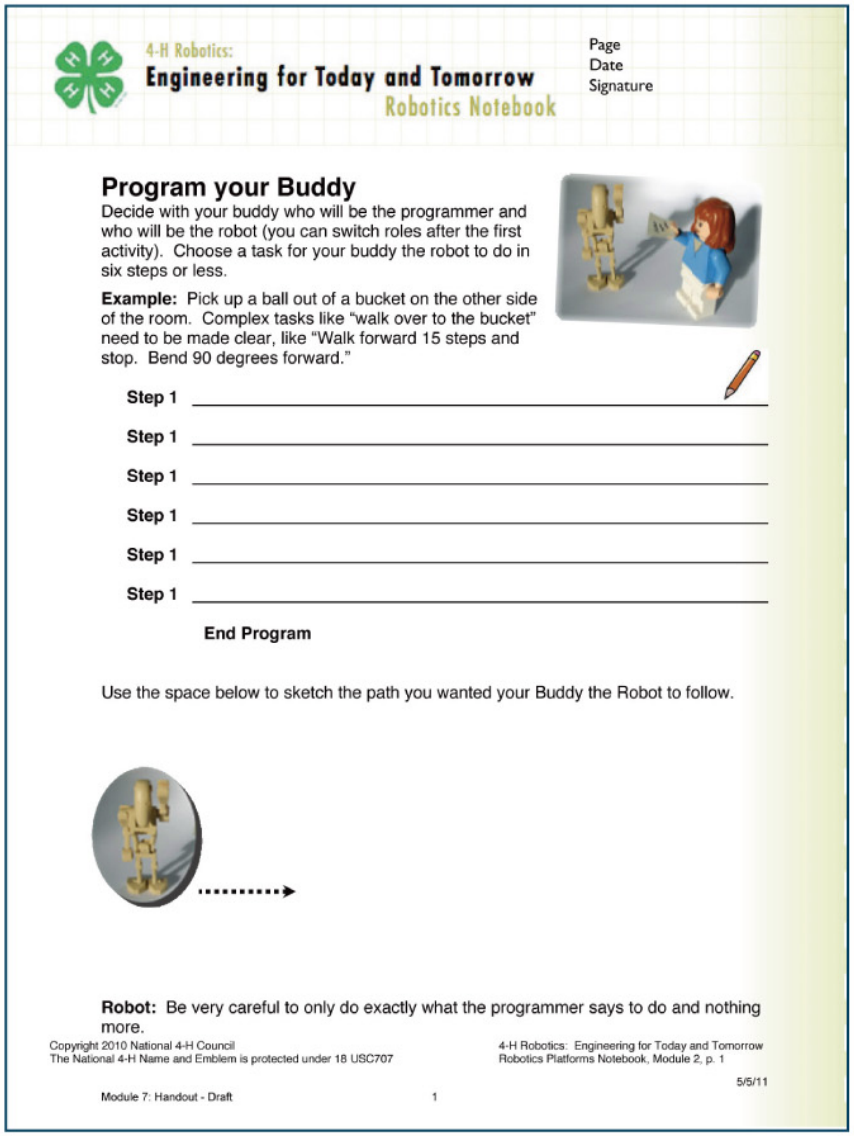
IDEA: Try connecting the left and right motor to ports B and C and the middle motor to port A.

Route Cables from the Motors to the NXT Brick

My Buddy The Robot

Robotics Notebook

Module 2, Page 1



4-H Robotics:
Engineering for Today and Tomorrow
Robotics Notebook

Page
Date
Signature

Program your Buddy

Decide with your buddy who will be the programmer and who will be the robot (you can switch roles after the first activity). Choose a task for your buddy the robot to do in six steps or less.

Example: Pick up a ball out of a bucket on the other side of the room. Complex tasks like "walk over to the bucket" need to be made clear, like "Walk forward 15 steps and stop. Bend 90 degrees forward."

Step 1 _____

Step 1 _____

Step 1 _____

Step 1 _____

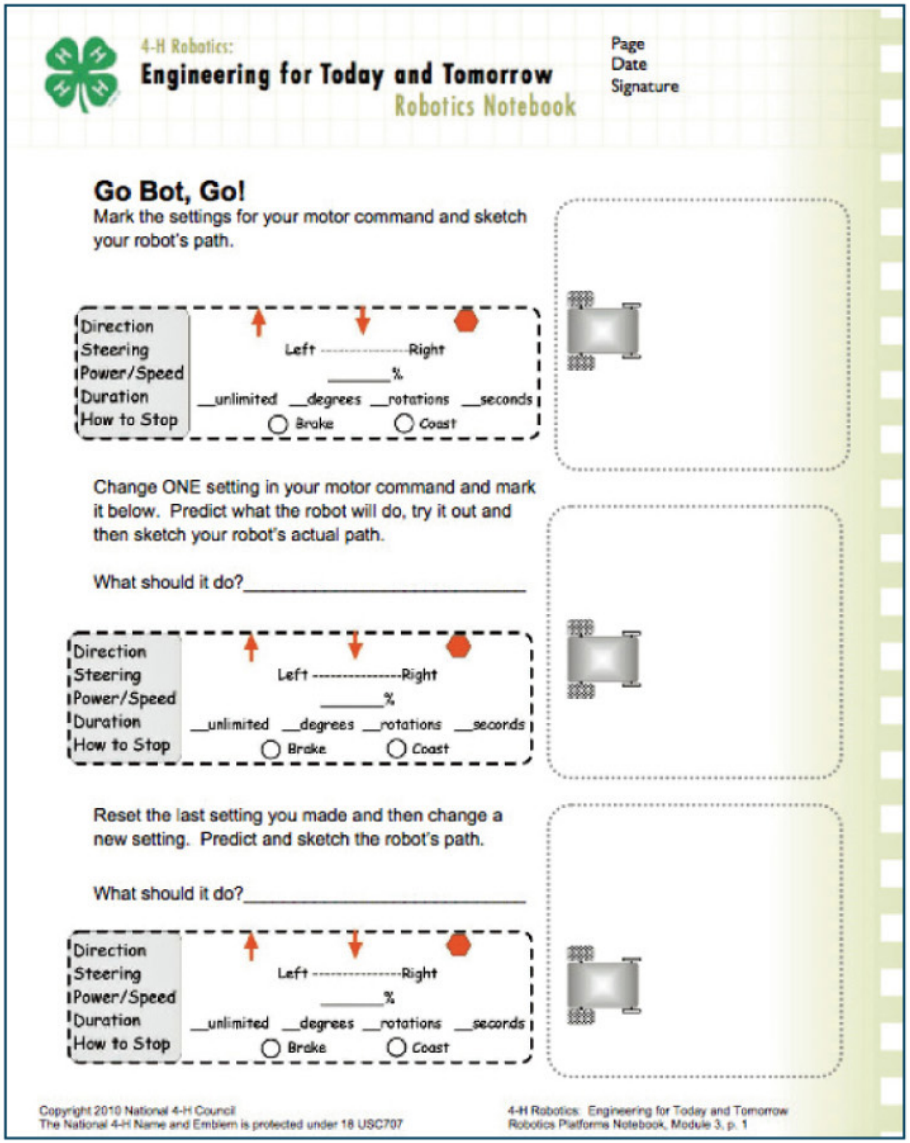
Step 1 _____

Step 1 _____

End Program

Use the space below to sketch the path you wanted your Buddy the Robot to follow.

Robot: Be very careful to only do exactly what the programmer says to do and nothing more.



4-H Robotics:
Engineering for Today and Tomorrow
Robotics Notebook

Page
Date
Signature

Go Bot, Go!

Mark the settings for your motor command and sketch your robot's path.

Direction: Left ---------- Right
Steering
Power/Speed: _____%
Duration: __unlimited __degrees __rotations __seconds
How to Stop: ○ Brake ○ Coast

Change ONE setting in your motor command and mark it below. Predict what the robot will do, try it out and then sketch your robot's actual path.

What should it do?_____

Direction: Left ---------- Right
Steering
Power/Speed: _____%
Duration: __unlimited __degrees __rotations __seconds
How to Stop: ○ Brake ○ Coast

Reset the last setting you made and then change a new setting. Predict and sketch the robot's path.

What should it do?_____

Direction: Left ---------- Right
Steering
Power/Speed: _____%
Duration: __unlimited __degrees __rotations __seconds
How to Stop: ○ Brake ○ Coast

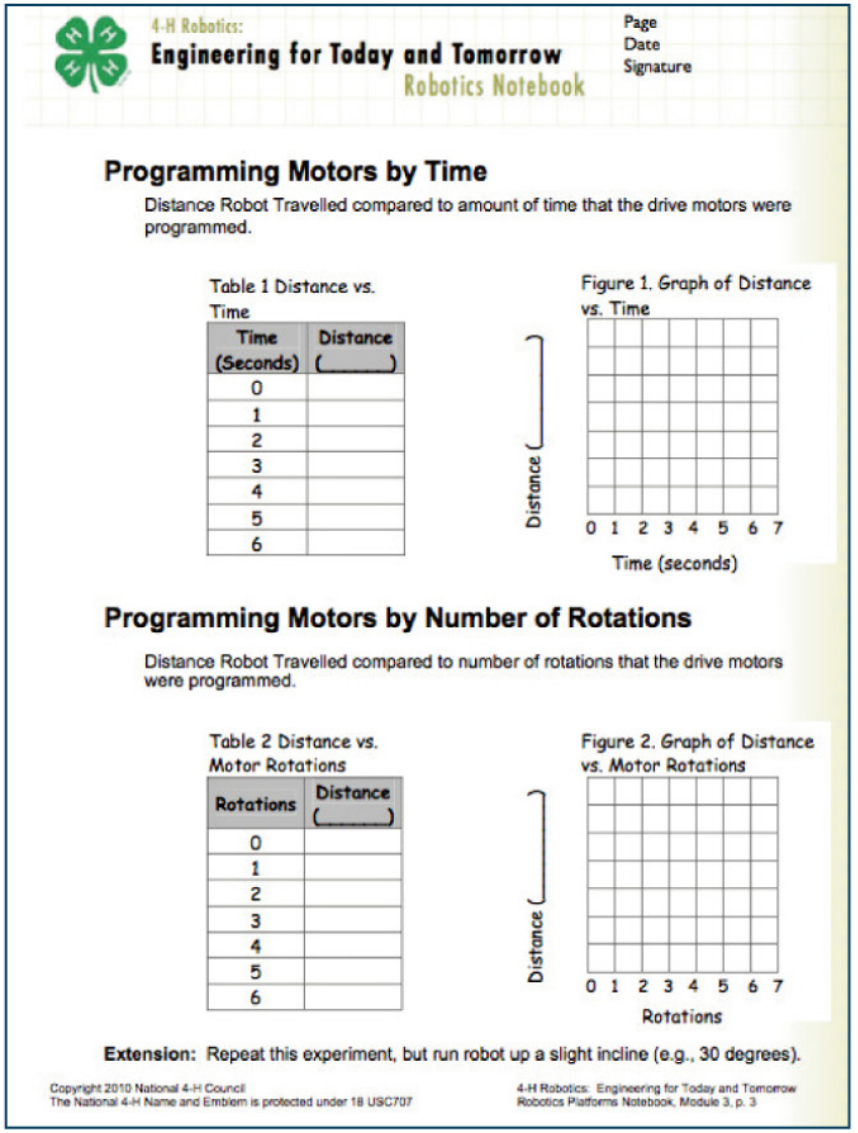
Go, Bot, Go!

Robotics Notebook

Module 3, Page 1

Robotics Notebook

Module 3, Page 3



4-H Robotics:
Engineering for Today and Tomorrow
Robotics Notebook

Page
Date
Signature

Programming Motors by Time

Distance Robot Travelled compared to amount of time that the drive motors were programmed.

Table 1 Distance vs. Time

Time (Seconds)	Distance (_____)
0	
1	
2	
3	
4	
5	
6	

Figure 1. Graph of Distance vs. Time

Programming Motors by Number of Rotations

Distance Robot Travelled compared to number of rotations that the drive motors were programmed.

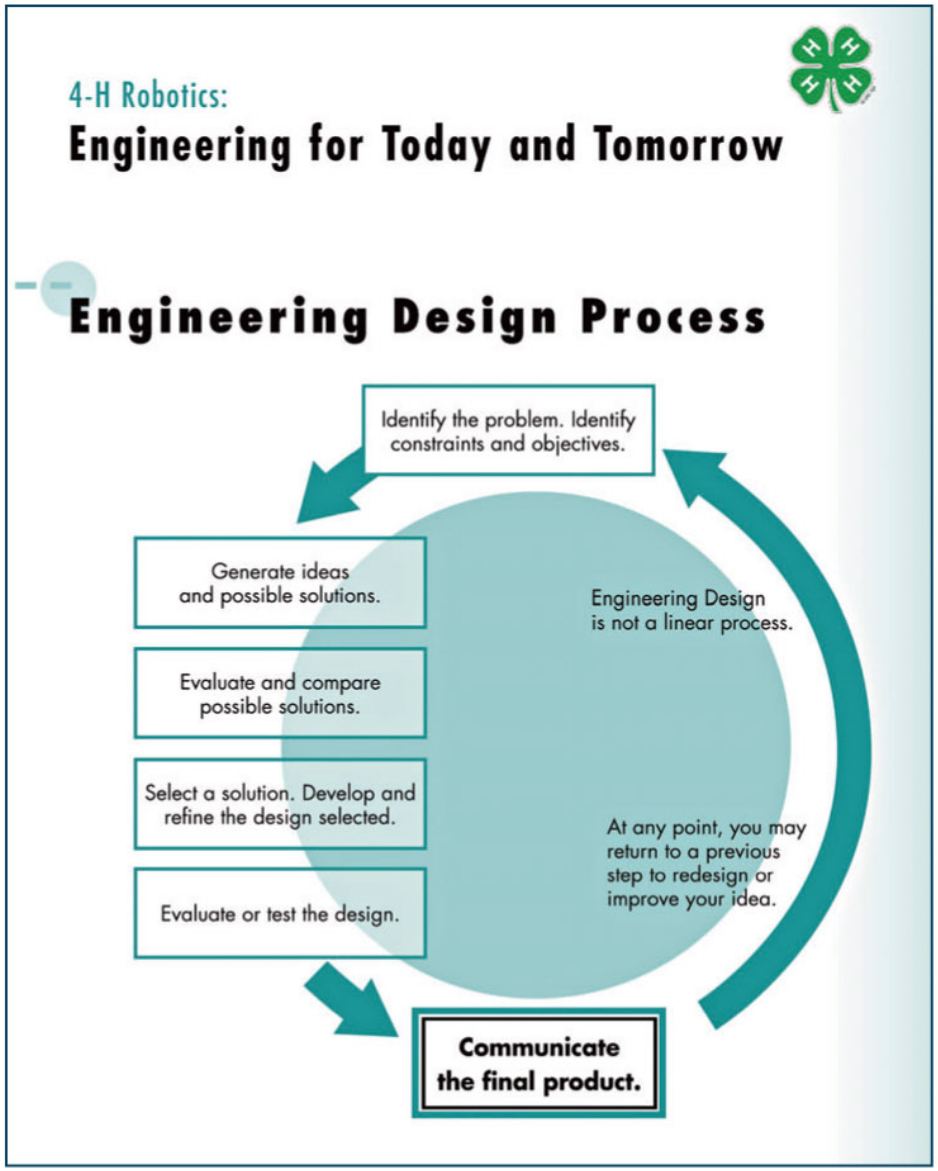
Table 2 Distance vs. Motor Rotations

Rotations	Distance (_____)
0	
1	
2	
3	
4	
5	
6	

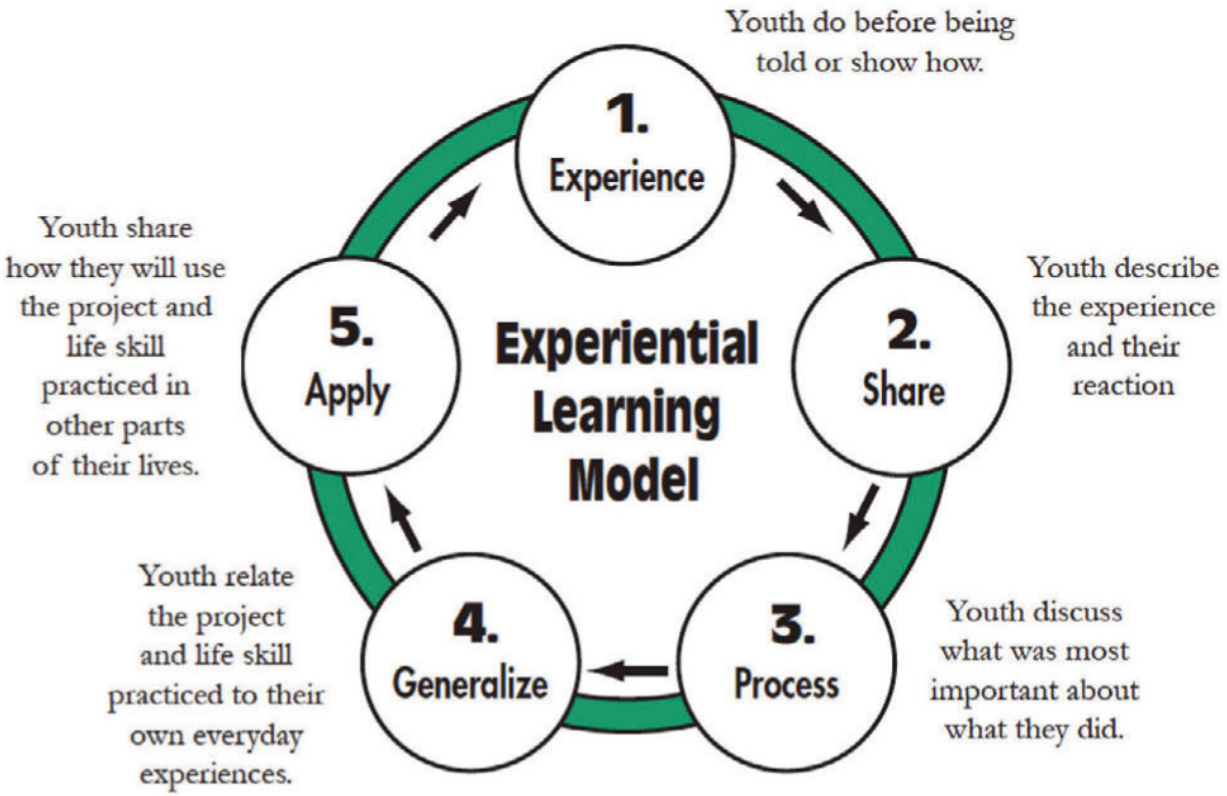
Figure 2. Graph of Distance vs. Motor Rotations

Extension: Repeat this experiment, but run robot up a slight incline (e.g., 30 degrees).

Engineering Design Process



Experiential Learning Model



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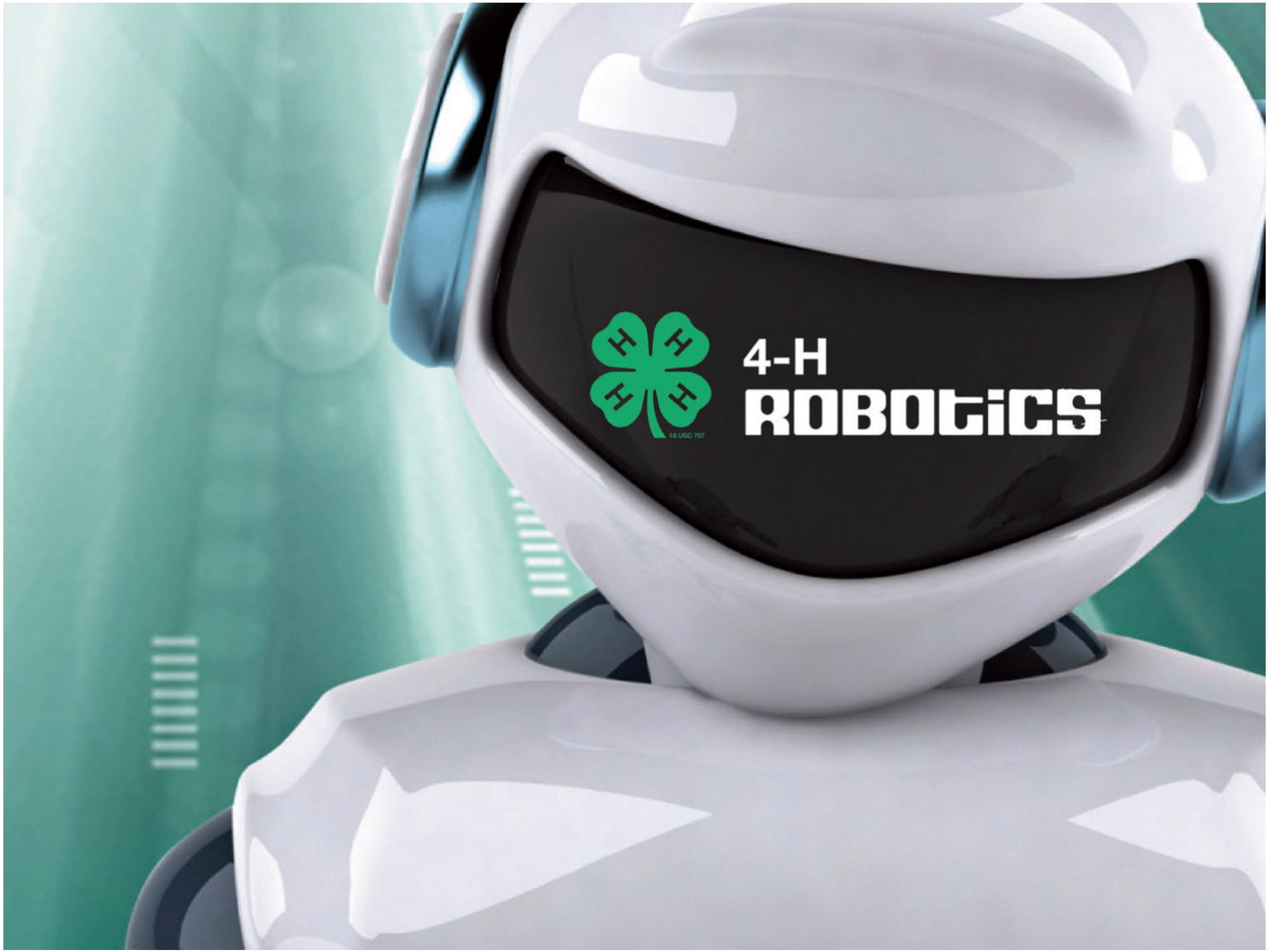
Closing and Questions

- Developed personal knowledge to draw upon when leading *Robotics Platforms*
- Identified the components of the LEGO® MINDSTORMS® NXT Kit and used it to build and program a robot
- Developed strategies for implementing the Engineering Design Process and Experiential Learning Model with youth


4-H
ROBOTICS
18 USC 707