Lego Robotics
An annotated, digested version of Curriculum Development Sessions
Advanced Robotics Workshop July 9-11, 2001
Hosted by TechBoston

Classroom hints:

1) check parts regularly - especially the key ones (motors, sensors)
2) have everyone keep a journal of what they do - individuals, not partners
3) boy girl boy girl ... where they sit matters
4) partners - generally let them choose their own partners
5) children are a reflection of their parents
6) "getting along"
   "I'm not getting involved; you have to work it out yourselves."
   formal conflict resolution
   diversity awareness
   time outs
7) don't use the halls for robots during MCA's testing
8) "girl equity" - keep the boys from diving in too fast; girls seem to take to K'nex more readily than Lego, Why?
9) How often can you do Lego - how much will determine you lesson plans
    Ideal: 45 minutes per day 2 times per week for 40 weeks
    Boston Latin: 260 total minutes to cover computer literacy, word processing, PowerPoint, robotics
    Hernandez: 45 minutes per day 5 days per week for 10 weeks

How to talk about programming:

Precise Language is needed - shorthand sketch tool? words?
   traffic light: green light = start; red light = stop
   motors and sensors
   structures: loops, forks, branches, merges
   modifiers: direction, power level, port, time

Refrigerator magnets of icons for classroom teaching tool? Large poster of icons?
Flash? Inspiration?

Curricular by-products (FW):

screen objects vs. real objects
metacognition
recipe for shapes -- eg., triangle: do 3 times {forward :distance right-turn 120 degrees}
habits of science - experiments, predictions, back to scratch
group dynamics and conflict resolution
number sense (seconds, speed, distance)
pattern sense
geometry sense
measurement
programming and coding
probability
come up with own logic (most innovative, hardest workers, craziest) & solve it --> not prescriptive

**Challenge: Build an M&M serving device (FW):**

- motor cycles drawer into hopper and back out
- out pops M&M into drawer
- light sensor "sees" color ?
- trap door releases M&M into bowl

**Electrical Resistance Play (FW):**

<table>
<thead>
<tr>
<th></th>
<th>Strawberry</th>
<th>Grape</th>
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<tbody>
<tr>
<td>Ohmmeter</td>
<td>800K</td>
<td>1 Mega-ohm</td>
</tr>
<tr>
<td>RCX</td>
<td>420</td>
<td>600</td>
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</tbody>
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**Robo Curriculum Outline (FW):**

0) Care of the Lego kits
1) Have students just build with Lego to get familiar with pieces
2) Introduce Robo basics
   - what's a robot?
   - robotic components
   - programming overview (PBJ)
3) Lego again -- build a simple robot from a plan or with a goal (CAD or other instruction)
   - build a vehicle with one motor
   - build a vehicle with two motors
4) Make robot do something
   - eg., program a 1 or 2 motor robot to travel a set distance (cross country trip; solar system travel)
   - eg., add touch sensors and use program 2 on RCX and drive it through an obstacle course or maze
   - eg., program the robot to drive a set distance, react to something (light, touch) and change behavior
   - eg., get through a maze - via programming!
5) Draw the robot, describe it on paper for yourself and others - Design Notebook
   - (features, instructions for building, programming, what's cool about it)
6) Lego robotic polygons; descriptive trip graphs (distance vs. time) -- see Geobot on Fred Wolflink's Web site
7) Real vs. ideal behavior and introduction to engineering
   - "To make it stronger, I took away some parts."
   - incremental design // radical design
8) Gears and pulleys
9) Olympics
   - completion of final project;
   - showcase skills & creativity;
   - PR: recruit students, parents, administrators

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