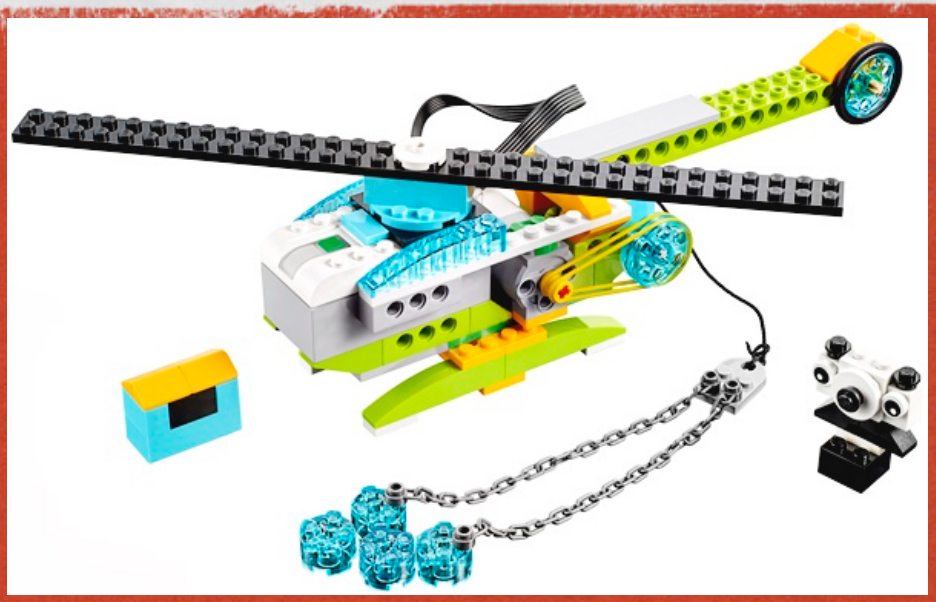
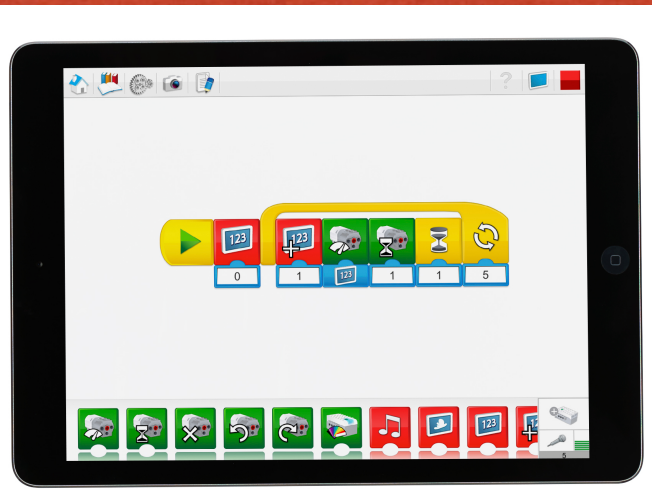


WeDo 2 Science with Robotics
Westhampton Elementary



John Heffernan, Ph.D.

5/3/2017

Introduction

- Elementary Science focus with integrated engineering and math
- Some background, research, and rationale
- MILO build and program
- Activity try outs
- Implementation planning and logistics

Tap creative play

- Are we tapping into the so important creative play of children in school, especially the kind associated with building?

Tap creative play

- It's more fun to actually be building something. If you took a class in robots and just learned about things, if the teacher just drilled information into your head, it would not be as fun as building and experiencing it to learn.
- *Grade 6 Girl 2*

Tap creative play

- Who is tapping into creative play? Are we?

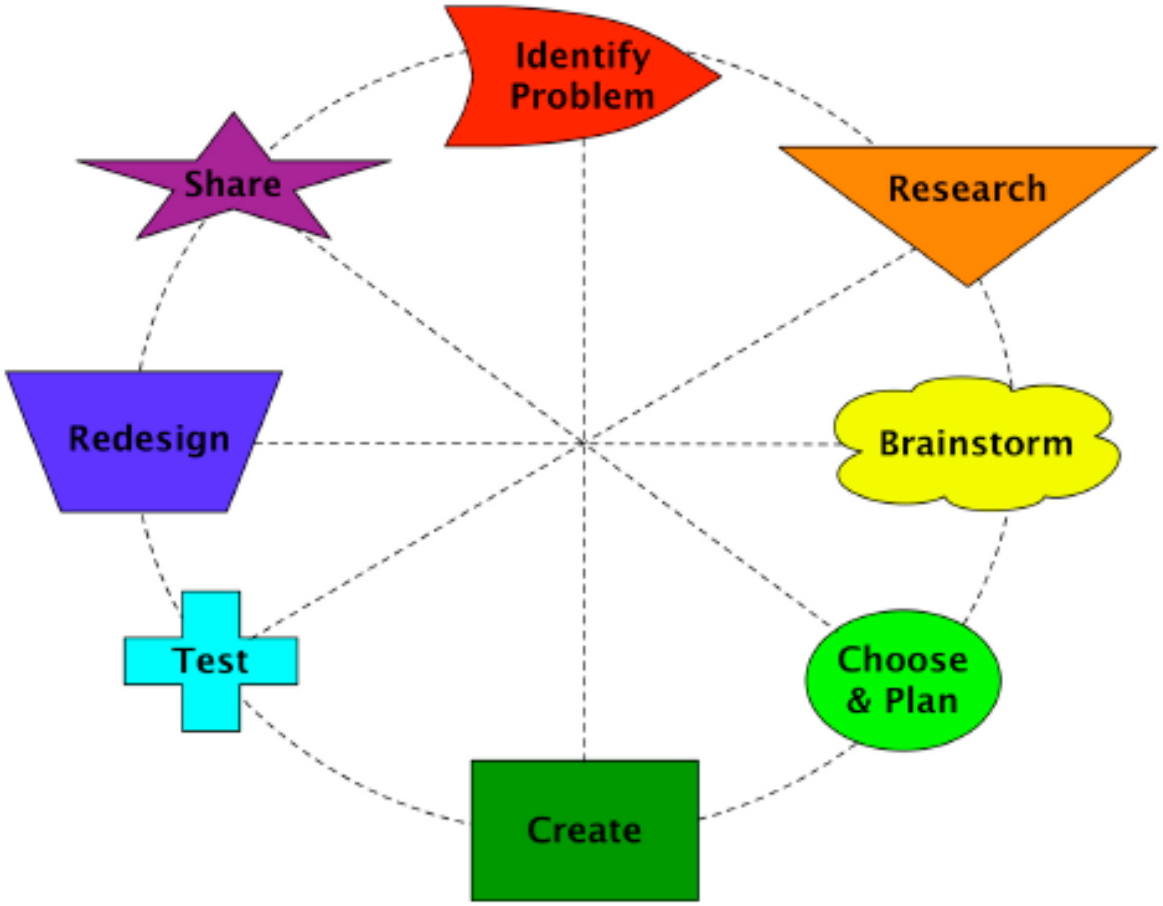

Bell

Lego Robots directly tap into the creative play urge of children in a healthy and educational way. A PK-6 robotics curriculum (such as Elementary Engineering Curriculum) is needed to support and sustain the natural engineering instincts of young children until formal engineering

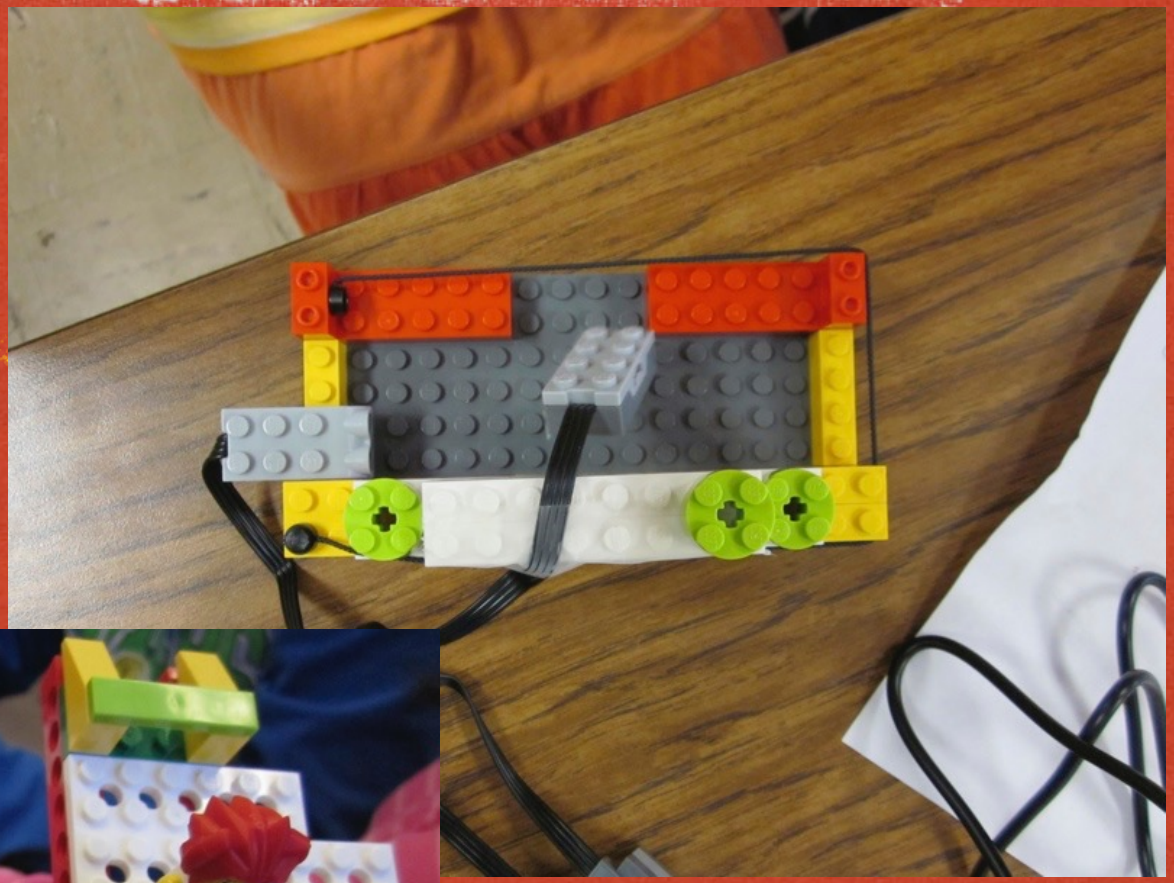
WHY ROBOTS?

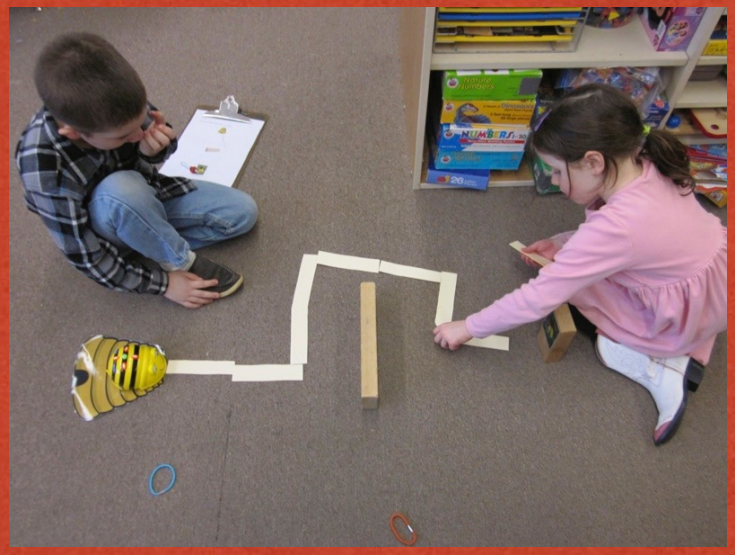
- Engineering can be taught in many ways, why Lego Robots?
- Familiar, fun, fantasy
- They can be programmed, adds “life”
- Tech component built in
- Math, science, ELA as well

Engineering Design Process



Courtesy - Dr Merridith Portsmore, Tufts CEEO





Grappling

Year 1 Clever Solution

Open Ended Challenges

Depth of Learning

15.5

GRADE 5/6 LEGO LESSONS #2 – MOTORS – NO SENSORS

TEAM [redacted] DATE 4/6/11

Follow the checklist below.

8.375
125

✓ The car turns clockwise for 5 seconds.

✓ The car turns counterclockwise for 5 seconds.

✓ The car goes in a straight line for 3 seconds.

✓ The car goes forward for 2 seconds, makes a 90-degree turn, goes forward for 2 seconds and stops.

✓ The car follows a taped square on the floor.

✓ The car follows a taped path on the floor.

8.38
2|16.75.0
-16
07
-6
1

3.1415
x 4
1256

16.74 2/3
9|150-72
-9
60
-54
6

12.56
x 12
25 12 63
12560
-36
150.72

GRADE 6 VELOCITY WORKSHEET

NAME Corie DATE _____

✓ Measure 10 feet and mark the distance in some way.

✓ Create a program that goes indefinitely. Set the motor power to 75%.

✓ Using the wall clock's second hand or a stopwatch, record how long it takes to go 10 feet. 11 seconds

Calculate the velocity (rate) of your robot in feet per second. Distance = rate x time.

Rate = 1.1 feet/second

Compare your results with others.

Why are results different for different teams? lighter robots

What was the fastest speed? 1.016 sec

Extra credit

What is the velocity of a robot car with the power set to 100%? 8sec per 10 foot or .8 in 1 sec

What is the slowest speed you can get the robot to go? _____

.900
11|100
-99
10
-0
10

1.1
10|11
10
10
-10
10
0

8
10|80
-80
0

Motivating

Fun

It was hard so it made us jump up and down when it finally worked. *Grade 5 Girls Team 1*

How is it different?

- [It's] Absolutely! [different from other schoolwork.] It's more interactive because mostly what we are doing in school is paperwork. With this you get to experiment, instead of just doing something, like math, you got a question, you figure it out. With this you can, change it up, experiment. *Grade 6 Boy 1*

- It's fun and different in a different way. I just think it is more fun. The way you think - easier is some ways, harder in some ways. The way you think is more fun to think that way than the other way. *Grade 4 Boy Team 2*

More Quotes

- I didn't think you would use all that math and science to build that robot. Grade 6 Girl 2
- It's more fun [than usual schoolwork.] It's a lot different – sometimes mathematical. You have to think in a different way. This would make this, would make this, happen. Each step is connected. Grade 4 Boy Team

What did you like about robotics?

- What did you like about robotics?

- 24 Mentioned the project as fun
- 15 Got to build/hands on
- 8 Different than other school work/special/exciting
- 7 Liked the programming even though it was hard
- 5 Cool
- 4 It was satisfying/exciting getting things to work
- 2 Liked the trial and error
- 2 Had to learn to compromise, work together
- 2 Got to move around, not stay in seat

RESEARCH - Interview results

- Student very aware of how they are being taught
- Prefer hands on activities and believe they learn better that way

Grade 6 Robots – Pre-Survey

NAME [redacted] DATE 3-30-11

What is a robot? a robot is a Mechanical divice that you can Program to do different thing.

What is engineering? Engineering is a type of work that involves Mechanics

How much do you agree or disagree with these statements? Circle One.

I want to be an engineer or scientists when I am older.

Strongly Agree Agree (Neither Agree or Disagree) Disagree Strongly Disagree

I like using computers and other technology.

(Strongly Agree) Agree Neither Agree or Disagree Disagree Strongly Disagree

Sharing Out

Teacher Interview

Student Interview

NGSS Practices

1. Asking questions (for science) and defining problems (for engineering).
2. Developing and using models.
3. Planning and carrying out investigations.
4. Analyzing and interpreting data.
5. Using mathematics and computational thinking.
6. Constructing explanations (for science) and designing solutions (for engineering).
7. Engaging in argument from evidence.
8. Obtaining, evaluating, and communicating information.

MA ETS G2 Standards

1.K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change that can be solved by developing or improving an object or tool.

1.K-2-ETS1-2. Generate multiple solutions to a design problem and make a drawing (plan) to represent one or more of the solutions.

2.K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs.

MA ETS G3 Standards

- 3.3-5-ETS1-1. Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.
- 3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.
- 3.3-5-ETS1-4(MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solution.

MA ETS G4 Standards

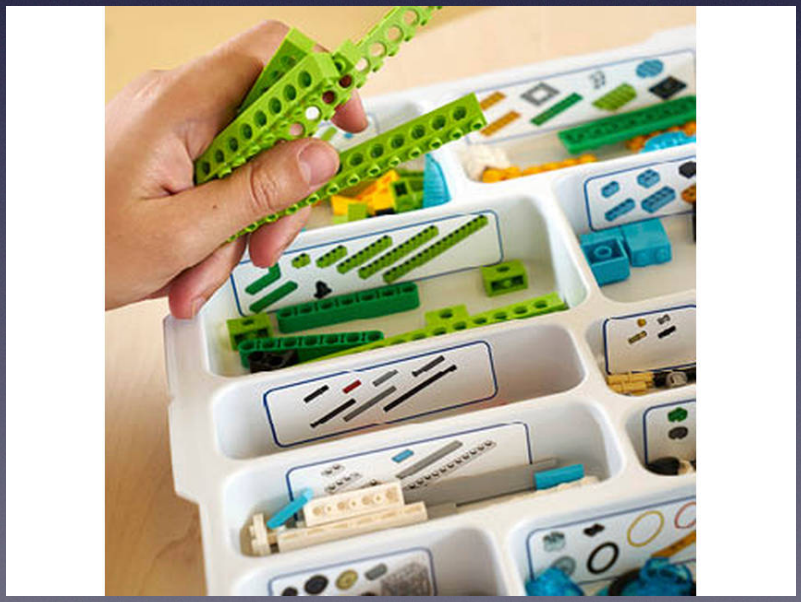
- 4.3-5-ETS1-3. Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of tests to redesign a model or prototype.
- 4.3-5-ETS1-5(MA). Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.

WeDo 2 Basics

- Bluetooth connection to tablet or computer
- Untethered
- New pieces
- New NGSS curriculum (50-70% grades 2-4)

What Does WeDo 2 Get Us?

- What are the advantages of WeDo 2 over WeDo in terms of:
  - Built in curriculum?
  - Inherent power of pieces?
  - New sensors and motor?
  - Being untethered?
  - Being tablet enabled?
  - Other?



Software Differences

- Tablet based
- Very similar to WeDo 1 except:
- Click and hold may not be intuitive on computers
- Time in seconds
- New backgrounds and sounds
- Motion (distance) sensor changes (closer, farther, any change)

Lobby and Content Editor

- New Lobby, content editor, help (quick tour)

Curriculum

- Different levels of support: getting started, guided, open, base models (quick tour)

Free Explore

- Look at kit pieces, connect bluetooth, try software, check out curriculum, help, lobby, Teacher's Guide (click Info icon), build MILO

Sample Project (Together)

- Robust Structures

Curriculum and NGSS Standards

- See pages 20-21 in TG for list of projects
- See pages 22-26 in TG for list of NGSS standards

Next Projects (2x)

- Pick a guided project that would be good for your grade level (all different)
- Report out

Open Project

- Pick a open project that would be good for your grade level (all different)
- Report out

Integrating with Other Science Resources

- What resources would need to be added for science background knowledge (if any)?

Grade 2-4 Sequence

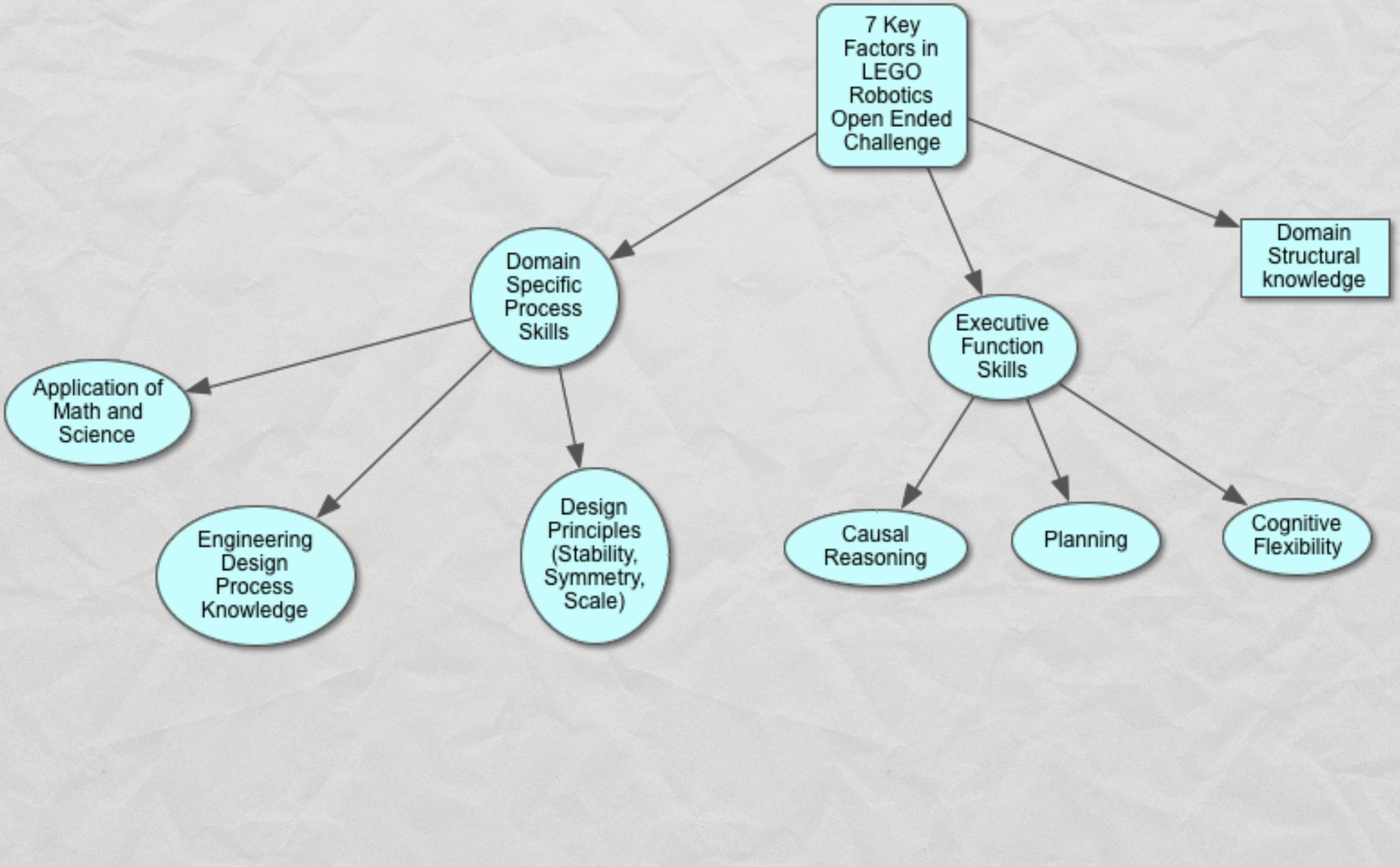
- Choose a preliminary grade 2-4 sequence

Logistics and Plan

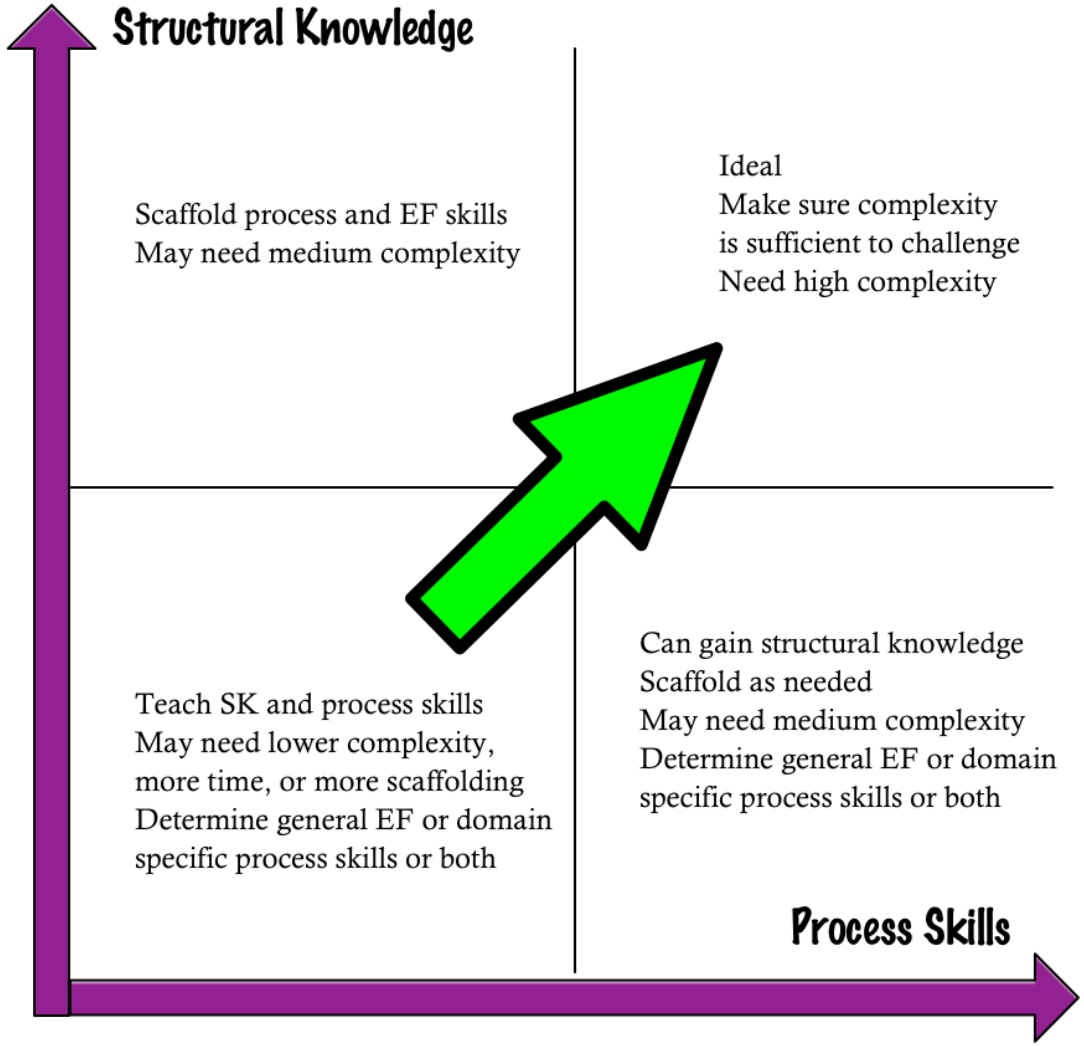
- Grant deliverables
- Delivery model
- Kit sharing
- Computer specifics

Amusement Park Ride

- Design a safe and interesting amusement park ride that uses a motor. You may wish to add sensors. Create a poster that advertises your ride and shows important parts of your ride. See handout.


7 Key Factors in LEGO Robotics Open Ended Challenge
Domain Specific Process Skills
Application of Math and Science
Engineering Design Process Knowledge
Design Principles (Stability, Symmetry, Scale)
Executive Function Skills
Causal Reasoning
Planning
Cognitive Flexibility
Domain Structural knowledge

Knowledge and Skills



Final Thoughts?

- What is the most important thing you learned?
- What will be a challenge for you?
- How will this program benefit your students?

Resources

- jheffernan@verizon.net
- http://www.kidsengineer.com/

Materials List

- Handouts - slides X (post to KE)
- Laptop and dongle and power cord X
- Evaluation X (hardcopy)
- Sign In Sheet X (hardcopy)
- BTLE dongles (at WES)
- Teacher's Guide (hardcopy) - selected pages (see slides)?
- Teacher's Guide (PDF)
- WeDo 2 Kits
- Batteries?