

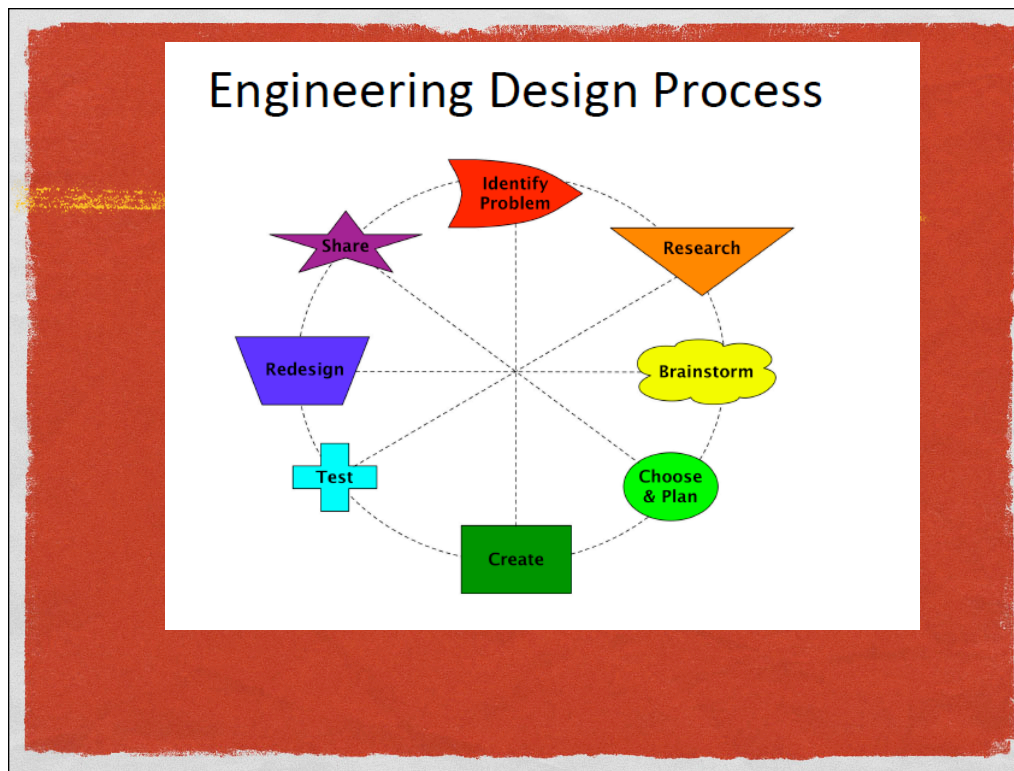
INTRODUCTION TO  
ELEMENTARY AND MIDDLE  
SCHOOL ROBOTICS

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10/25/2012

# INTRODUCTION

- Elementary and Middle School Engineering Education with a focus on robotics
- Some background
- Activities
- Wrap-Up



Go over and explain: step 1 sometimes overlooked but critical. The same, in essence as other processes.

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





What's going on here? Have you seen your kids doing something like this? What does this have to do with learning?

# TAP CREATIVE PLAY

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

Isn't that where the urge to engineer comes from?

## 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

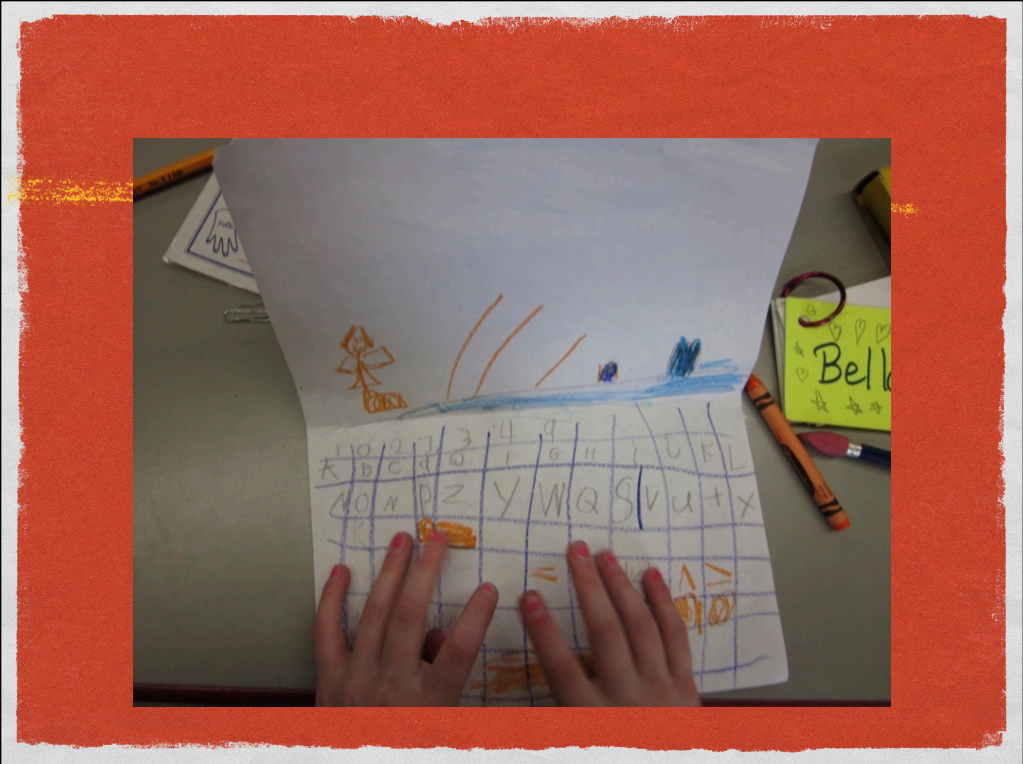


- Who is tapping into creative play? Are we?



What we see at recess? Are they not getting it at school?



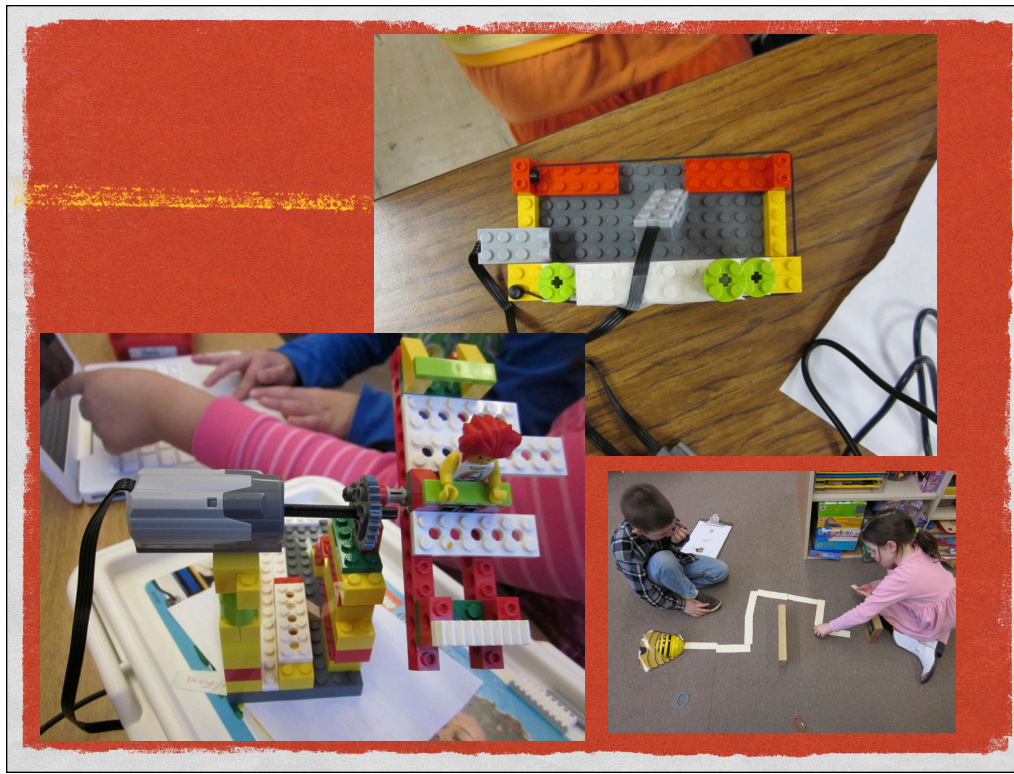


Lego Robots directly tap into the creative play urge of children in a healthy and educational way



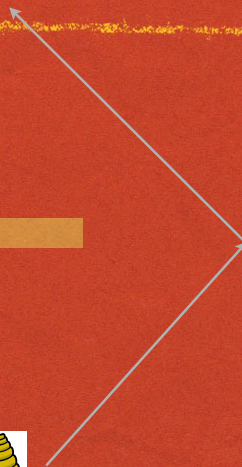
# WHY ROBOTS?

- 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



Some open ended challenge design from grades K, 2, and 4. Name challenges. Challenges are important to really experience engineering and also to see where the students can take things. Critical for (underserved) students who need more challenges.

# YEAR 1 CLEVER SOLUTION



# DEPTH OF LEARNING

15.5

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

TEAM \_\_\_\_\_ DATE 4/6/11

Follow the checklist below.

- The car turns clockwise for 5 seconds. 8.375
- The car turns counterclockwise for 5 seconds. 1.25
- 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. 16.74  $\frac{2}{3}$
- The car follows a taped path on the floor.

8.375

$$\begin{array}{r} 2 \overline{) 16.750} \\ \underline{4} \phantom{00} \\ 12 \phantom{00} \\ \underline{12} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \end{array}$$

1.25

$$\begin{array}{r} 1 \overline{) 1.25} \\ \underline{1} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \end{array}$$

GRADE 6 VELOCITY WORKSHEET

NAME Cove 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 = 11 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 feet or

What is the slowest speed you can get the robot to go? .8 in 1 sec

$$\begin{array}{r} 200 \\ 11 \overline{) 1100} \\ \underline{11} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \\ \underline{00} \phantom{00} \\ 00 \phantom{00} \end{array}$$

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How much more meaningful is this than a workbook sheet on velocity, long division? Learning is in context of solving of problem. Saw many examples where deeper understanding was missing until they had to actual use their math. Think of one!???

MOTIVATING



# FUN



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

Example of Scarlet running back and forth from computer to test area



## 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*

Do you think this is fun and engaging for kids?

# 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

Integration examples: solve a problem from a story (chair engineering, better mousetrap (Ralph), design an instrument, decorate robots

# 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 device that you can program to do different things.

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

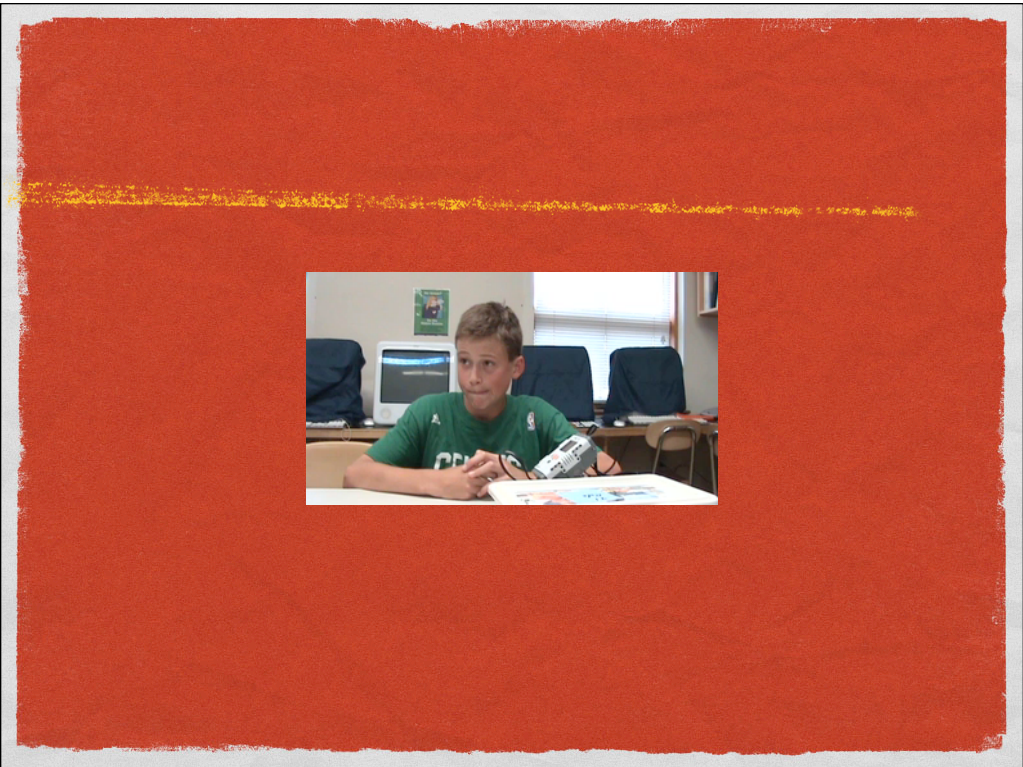
I like using computers and other technology.

Strongly Agree    Agree    Neither Agree or Disagree    Disagree    Strongly Disagree

Want to move the first question to the left so kids are not just consumers.

# TEACHER INTERVIEW





# DANCING BIRD ACTIVITY

- Build Dancing Bird with partner according to the directions
- Create a simple program to make the birds move for 10 seconds
- Do the LEGO created experiment with the pulleys and belts
- Embellish your program if time permits



# REFLECTION

- What STEM learning did you experience? 21st Century Skills?

# OPEN ENDED CHALLENGE

## OPEN ENDED ACTIVITY

- Build an amusement park ride that is fun and safe
- Only use parts in your kit
- 30-40 minutes
- Use words and/or pictures to plan a ride
- “Mistakes” are progress

# REFLECTION

- What STEM learning did you experience? 21st Century learning?
- How did this differ from the more structured activity?
- How did you experience the engineering design process?

## Resources

- [jheffernan@hr-k12.org](mailto:jheffernan@hr-k12.org)
- <http://www.kidsengineer.com/>

# MATERIALS LIST

- WeDo Kits (5)
- NXT robot (1)
- BeeBot (1)
- Dancing Birds Handouts (10)
- Ride Challenge Handout (10)
- Sound handouts (10)
- Laptops (5)
- Post slides online
- Laptop, video adaptor, power cord, mouse