

# Introduction to Elementary Robotics

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1/28/2015

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## Introduction

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

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## Tap creative play

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

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## 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*

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## Tap creative play



- Who is tapping into creative play? Are we?



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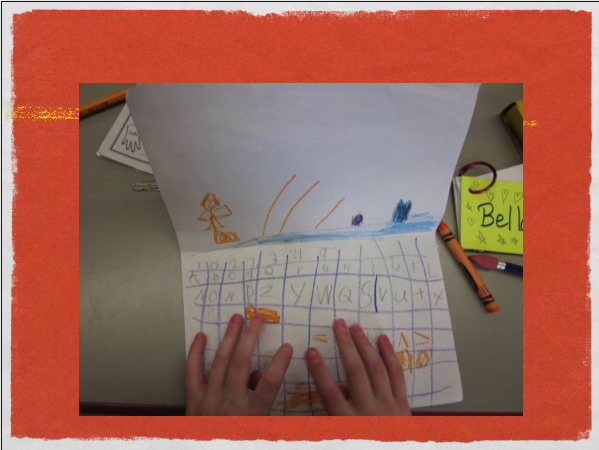
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Lego Robots directly tap into the creative play urge of children in a healthy and educational way. A PK-6 robotics curriculum (such as Elementary Engineering Curriculum) is needed to support and sustain the natural engineering instincts of young children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



The complex block contains three small images arranged horizontally. From left to right: a silver and black Lego Mindstorms robot; a yellow and red Lego motor assembly; and a yellow and black striped cartoon bee.

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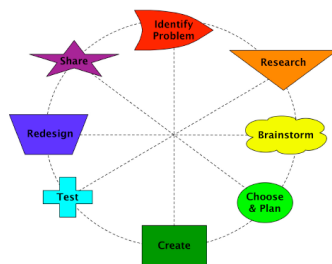
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## WHY ROBOTS?

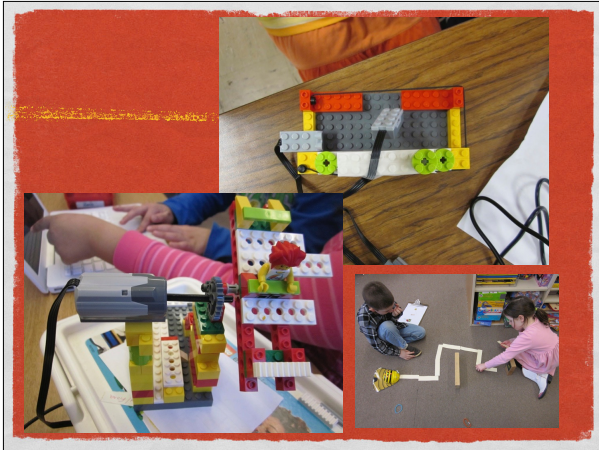
- Engineering can be taught in many ways, why Lego Robots?
- Familiar, fun, fantasy
- They can be programmed, adds "life"
- Tech component built in
- Math, science, ELA as well

## Engineering Design Process



Courtesy - Dr Merridith Portsmore, Tufts CEED





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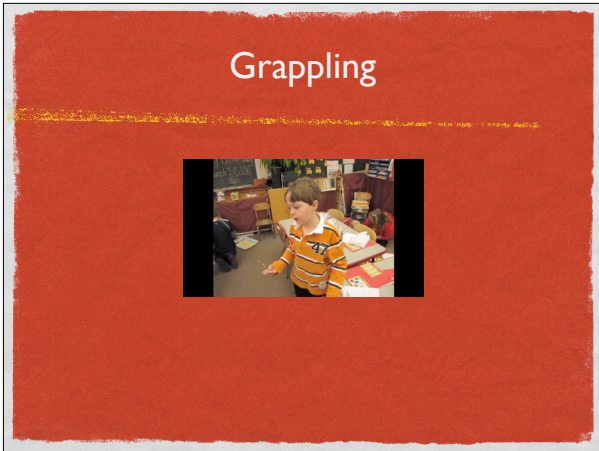
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# Year 1 Clever Solution



Open Ended Challenges

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# Depth of Learning

155

GRADE 54 LEGO LESSONS #2 - MOTORS - NO SENSORS

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

Follow the checklist below.

- The car turns clockwise for 5 seconds. 8:35
- 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 tapered path on the floor. 16743

*Handwritten math:*

$$216.75 \div 1.4 = 154.82$$

$$314.16 \div 2 = 157.08$$

$$125.6 \div 0.8 = 157.0$$

$$150.72$$

GRADE 4 VELOCITY WORKSHEET

NAME Case DATE \_\_\_\_\_

- Measure 10 feet and mark the distance to come stop.
- 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 (feet) of your robot to feet per second. Distance  $\div$  time = three.

Rate = 11 feet/second

Compare your results with others.

Why are results different for different teams? lighter robots

What was the fastest speed? 10.16 sec

Extra credit

What is the velocity of a robot car with the power set to 100%? 8sec 800 to 900ft 0.8 in 1 sec

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

*Handwritten calculations:*

$$11 \frac{100}{10} = 1100 \div 10 = 110$$

$$101.6 \div 10 = 10.16$$

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## Motivating



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## Fun



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

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## 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 in 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*

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## 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*

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## 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

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## RESEARCH - Interview results

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

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Grade 6 Robots - Pre-Survey

NAME: \_\_\_\_\_ 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 scientist 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

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## Student Interview



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## 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 or birds if time permits

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## Reflection

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

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## Curriculum Sequence

- 1 – WeDo - Getting Started, Dancing Birds
- 2 – Drumming Monkey, Spinning Top, Ride Challenge
- 3 – Amazing Adventures (ELA), Car Challenge
- 4 – Soccer (Math), Burglar Alarm Challenge
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- 4 – Soccer (Math), Burglar Alarm Challenge

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## Grade Level Specific LEGO Lesson

- Build and program grade level specific LEGO lesson. See Teacher's Guide and Heffernan book. Do experiment(s).

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## Sample Open Ended Challenge

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

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## 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?

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## Day 2 Agenda

- In grade level teams, try all grade level curriculum
- Logistics - parts management, scheduling, lab, curriculum, support
- Final reflection
- Clean up

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## Final Thoughts?

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

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## Resources

- [jheffernan@verizon.net](mailto:jheffernan@verizon.net)
- <http://www.kidsengineer.com/>

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## Materials List

- Speakers
- Handouts (slides, grade specific lessons 1-4)
- Post handouts
- Laptop and dongle and power cord

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