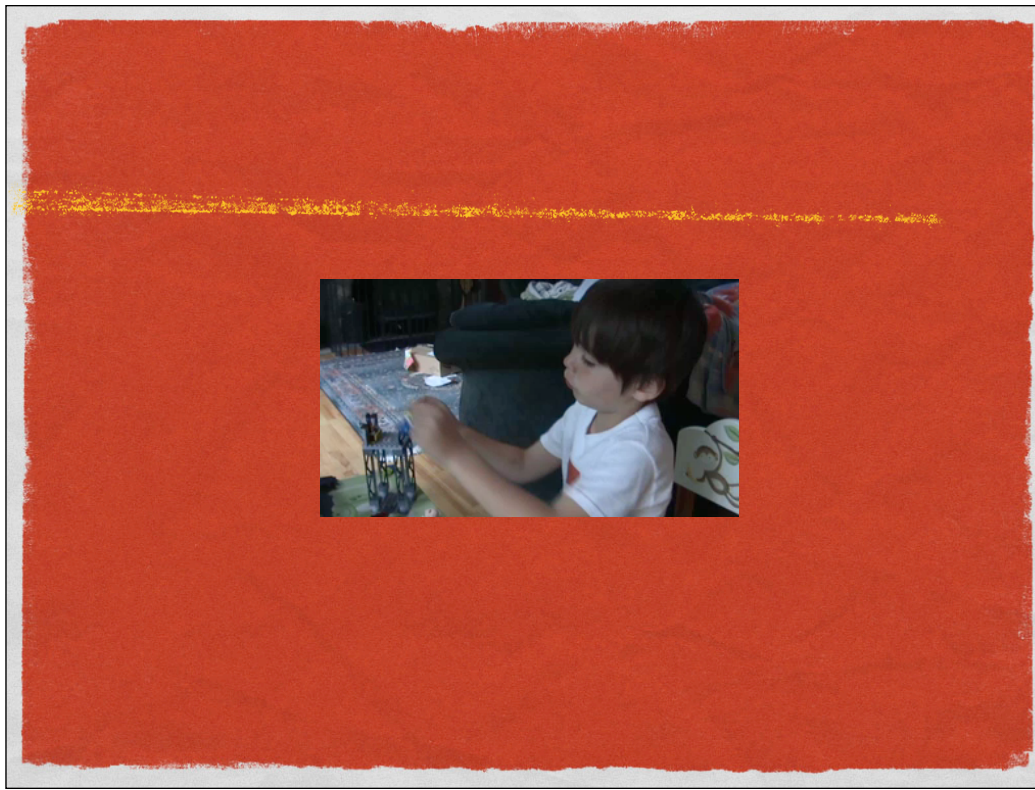


PK and K kids are natural engineers (give examples). PK and K classes have lots of materials and activities that support this. We take this away and then expect kids to be interested in engineering when they get to high school.



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 do we see at recess and the beach? Are they getting it at school? Corporations are tapping into this core urge to build and not always in a good way.

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



Constructive channeling of the urge to build and create. Go over each one and the grade levels.





## GOOD FOR BOYS

- We have found robotics especially good for boys with ADD and LD issues who do Legos at home and tech oriented boys that need challenges
- What other activities in elementary schools especially cater to boy's interests?

Examples: – writing, no hands-on, language oriented, sitting still, roughhousing, toys, video games. Are we providing healthy outlets for boy's culture? Examples: + video game creation, robotics, hands-on science, take apart centers



## GOOD FOR BOYS

- It was very interesting that we got to build a real, live robot. I never imagined I would build a robot. It was really cool. *Grade 5 Boy 1*
- It's fun because it allows you to challenge yourself in a different way than just your mind, because you have to be able to figure out how things go together because that's physical memory. *Grade 6 Boy 1*



# GOOD FOR GIRLS



- Girls don't always get to use Lego at home
- Need to be exposed to engineering before cultural constraints become strong

# 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?

# STEM PIPELINE

- STEM occupations are projected to grow by 17.0 percent from 2008 to 2018, compared to 9.8 percent growth for non-STEM occupations.
- STEM workers command higher wages, earning 26 percent more than their non-STEM counterparts.
- We need creators of technology, not just consumers.
- Will we be STEM competitive in the new global economy?

Can we wait until high school or college to start?



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.

# NATIONAL AND STATE STANDARDS

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 2*

*Teachers have integrated math, science, technology, programming, art, music, ELA*

*Other important 21st Century Skills, collaboration, communication, problem solving*

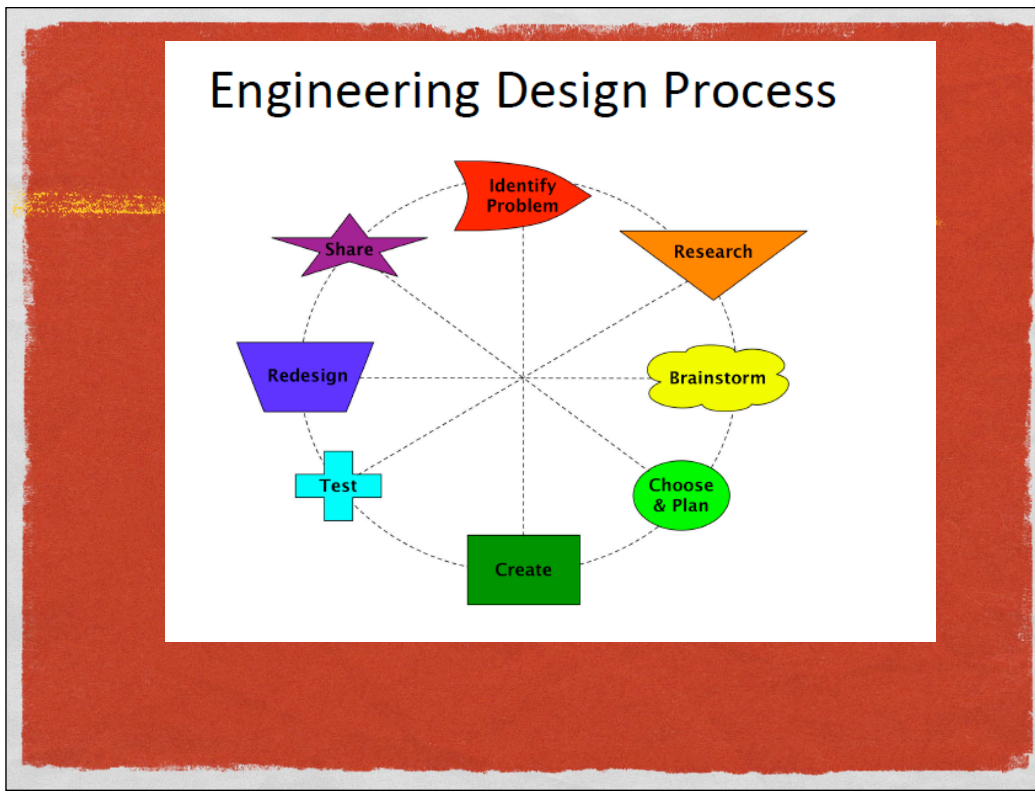
*National and state standards and tests will have much more engineering in them in the future*

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

# ENGINEERING

- Not all kids should or need to be engineers but:
  - We have created a lot of problems with our technology and will need ethical engineers and scientists to solve them
  - Practices a way of thinking based on reflection, fact based research, iterative and revision, collaboration, and sharing out





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

# GRAPPLING





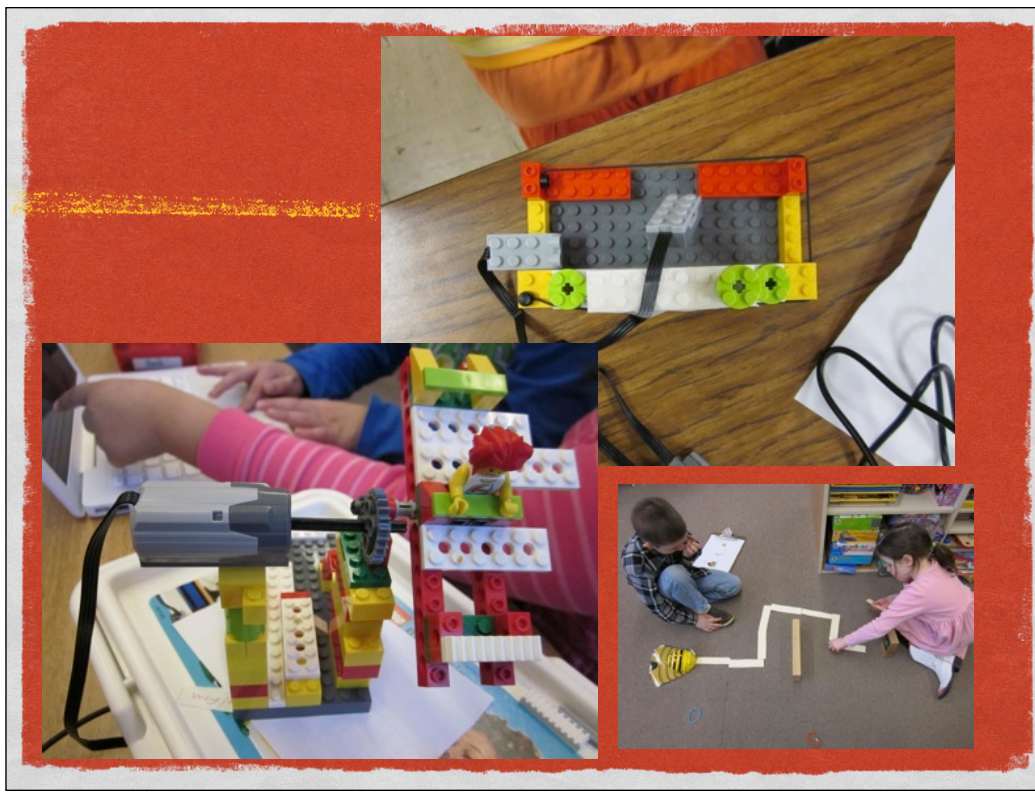
Open ended challenges are a change for the teacher.



# ENGINEERING DESIGN

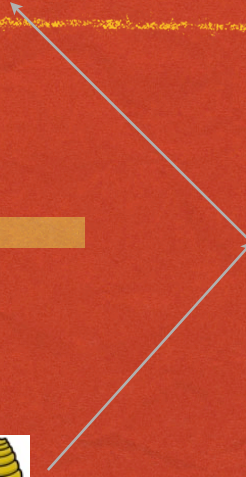
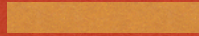


Grade 4 Burglar Alarm Example



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. 125
- 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<sup>2</sup>/<sub>3</sub>
- The car follows a taped path on the floor.

2 | 16.750

- 16

---

107

31415

x 41

---

1256

9 | 150.72

- 90

---

60

x 12

---

72

1256

x 12

---

15072

GRADE 6 VELOCITY WORKSHEET

NAME Coie 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 foot or

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

11 | 100

- 99

---

100

- 10

---

90

10 | 100

- 10

---

90

- 10

---

80

10 | 80

- 80

---

0

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!???

FUN



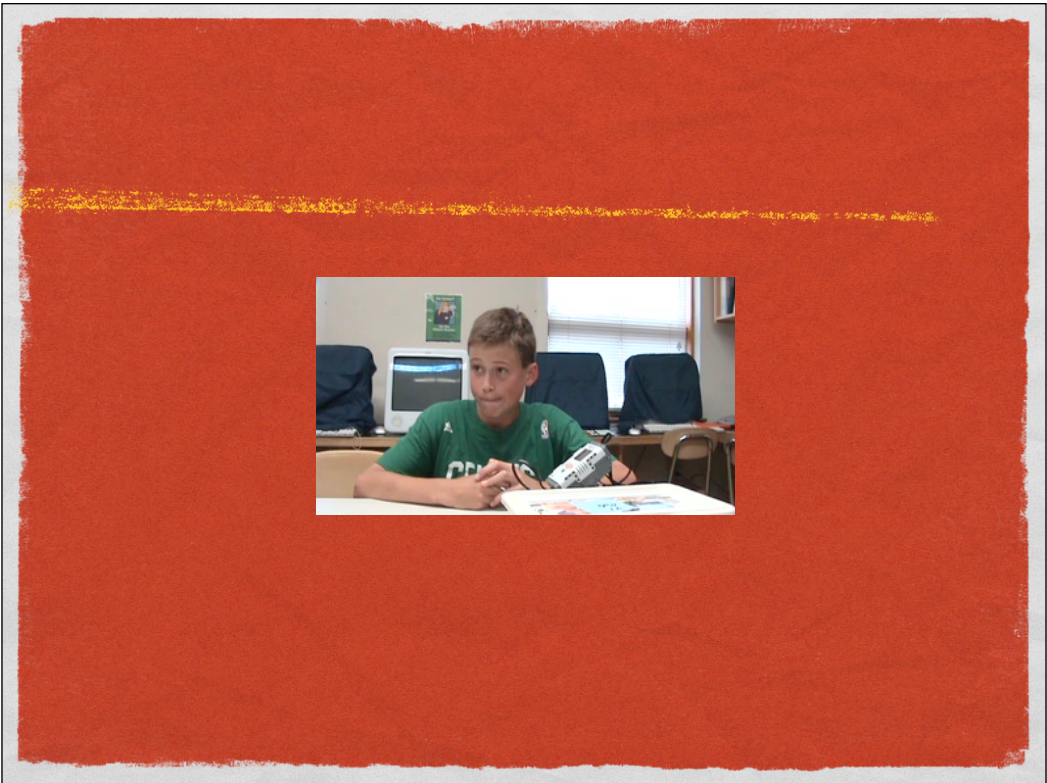
It was hard so it made us jump up and down when it finally worked. *Grade 5 Girls Team 1*

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

# CGS

- Trying to ascertain interest for NSF and other large grants
- Could find smaller grants and provide PD if there is interest
- Will be coming in and doing K BeeBots
- Other steps possible before robotics equipment is on hand







• [jheffernan@hr-k12.org](mailto:jheffernan@hr-k12.org)

• [kidsengineer.com](http://kidsengineer.com)