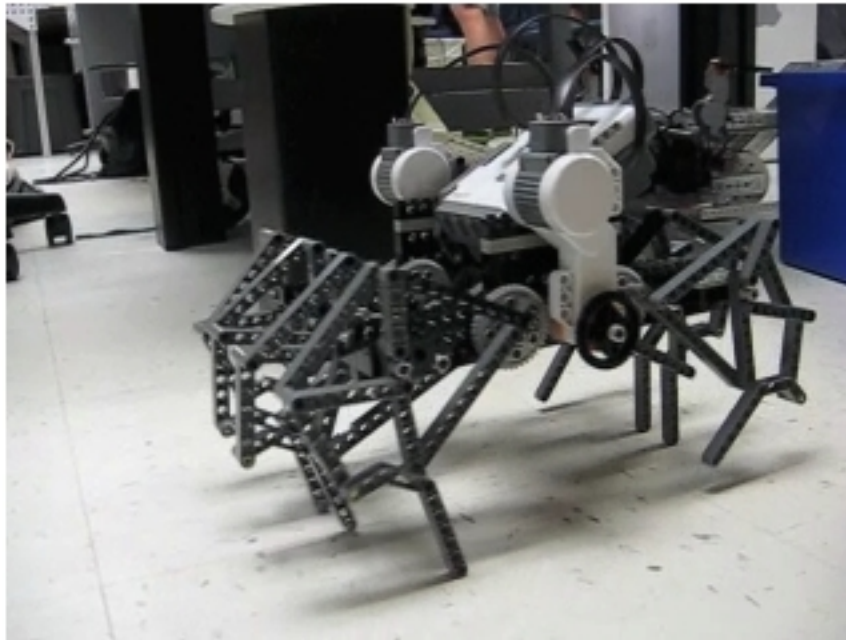


Changing How Students Learn: Using Engineering to Teach Innovation, K-College

Chris Rogers

9/19/13



Tufts UNIVERSITY | Center for Engineering
Education and Outreach



education

Science, Tech, Engng, Math Education

Memorization

Single Right Answer

No Creativity

No Opinions

No Arguments



http://theauburner.com/ryan_timekillers.html

Assessment



<http://www.straighterline.com>



Awaking Creativity and Innovation in the Classroom Through Early Engineering Education



- Education Research
- Engineering Research
- Outreach
- Professional Development

Kids Can....

The Problem

Want ...

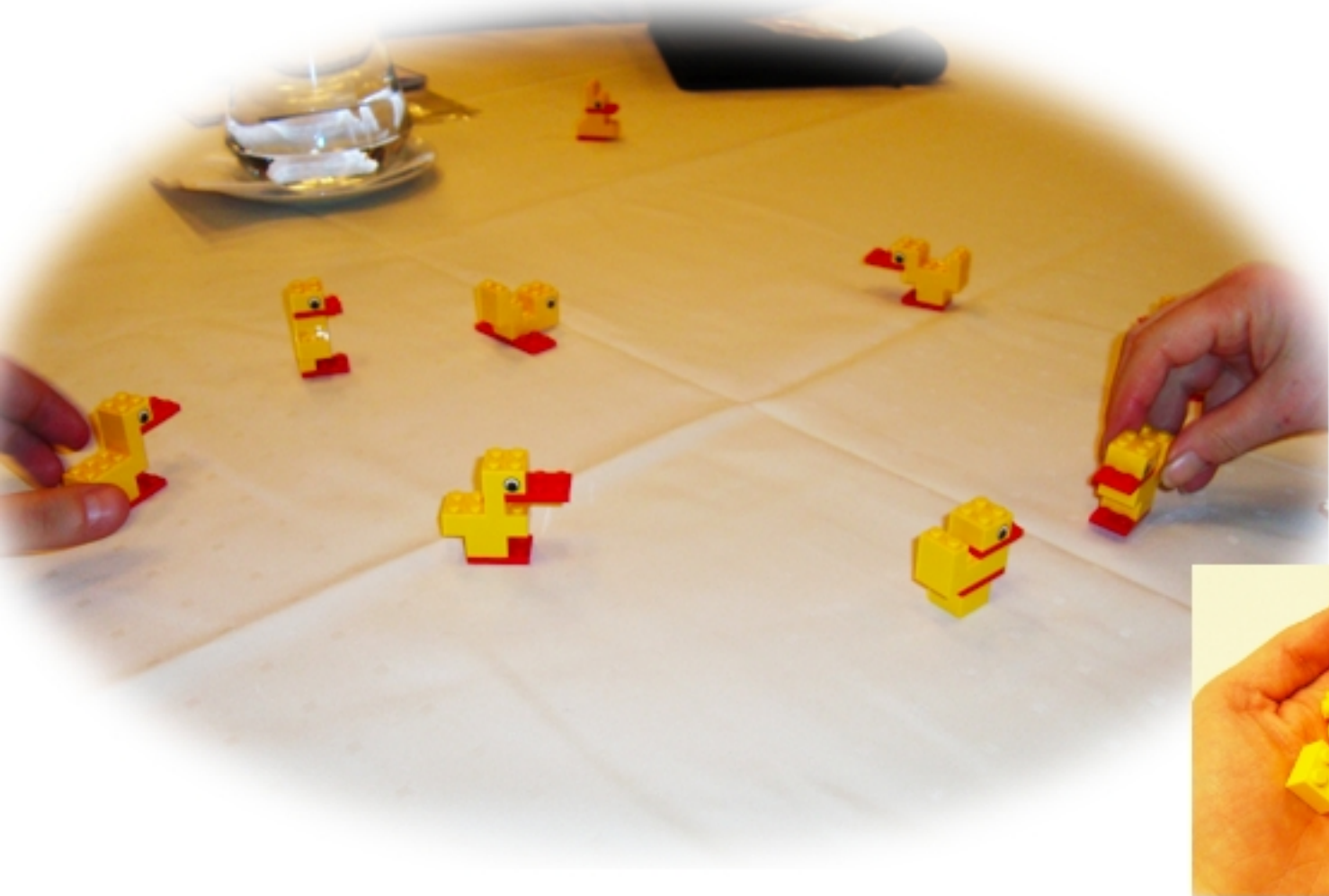
- *innovation*
- *creativity*
- *leadership*
- *problem solving*

Need ...

- *messy problems*
- *failure and resilience*
- *diversity of solutions*
- *teamwork*

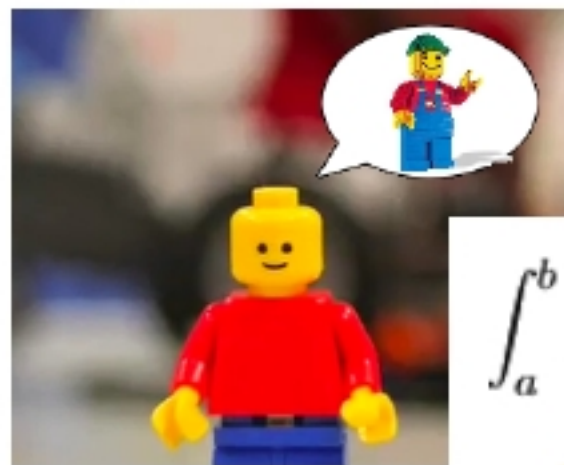


Many Different Solutions



Engineering Design

Set a goal



$$\int_a^b f(x) dx,$$



Plan a path



Fail and Iterate

Awakening Innovation

- All kids are budding engineers
eager to build, fail, iterate
- Teachers are a key part of the equation
just-in-time response to child thoughts
- The Classroom makes a difference
desks versus tables



<http://www.cceo.tufts.edu>

What is the Ultimate Teaching Goal?

1. curiosity (*why?*)
2. passion for finding answers (*learning*)
3. test validity of answers (*reflection*)
4. self-confidence (*transfer*)

What are the Beginnings of Engineering?

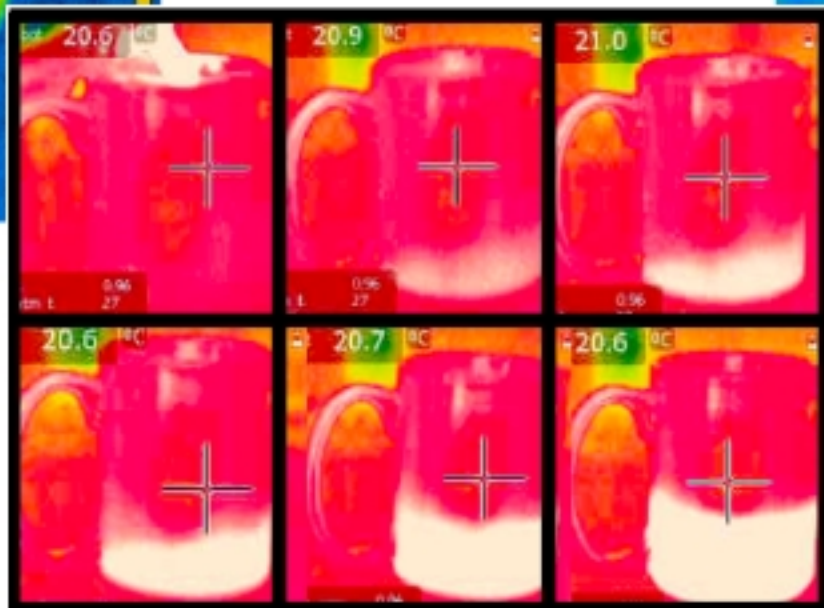
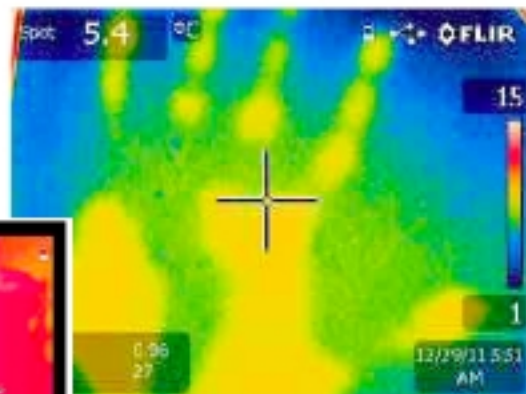
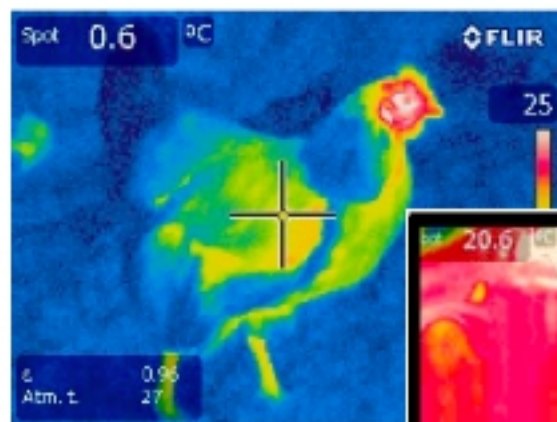
Curiosity

- *Authentic Questions*
- *Ask Why?*

S.A.M. Time Lapse



Teaching by Investigating



Seeing the unseen

Expeditionary Learning Schools



EXPEDITIONARY
LEARNING

Silly Walks

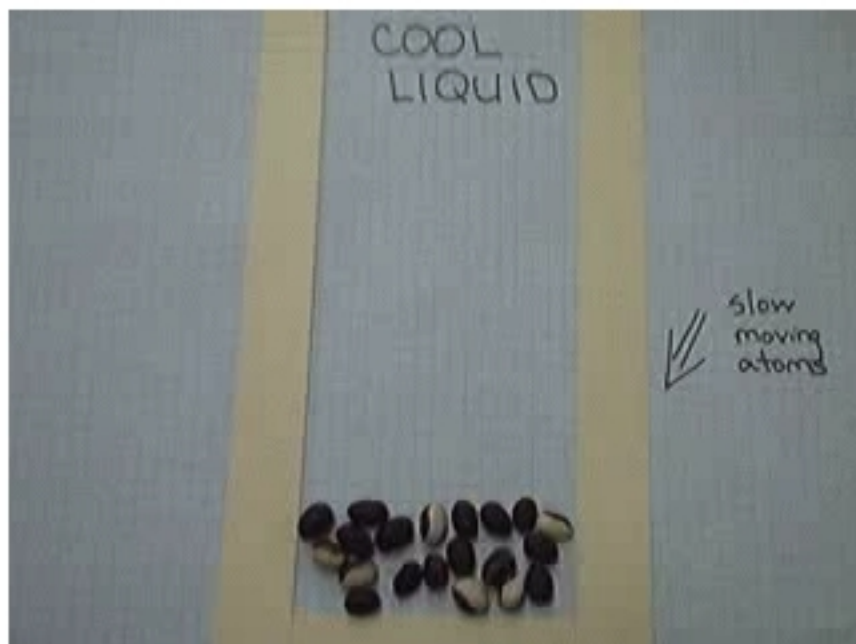


Univ of Zürich

Ideas

- *Student Ideas*
- *Physical Brainstorming*

S.A.M. Telling the Story



<http://www.samanimation.com>

Framing the problem

...it would take longer.



But how would they get the wood?



I don't think it would be like, they have to pay for it.



Driving LEGO



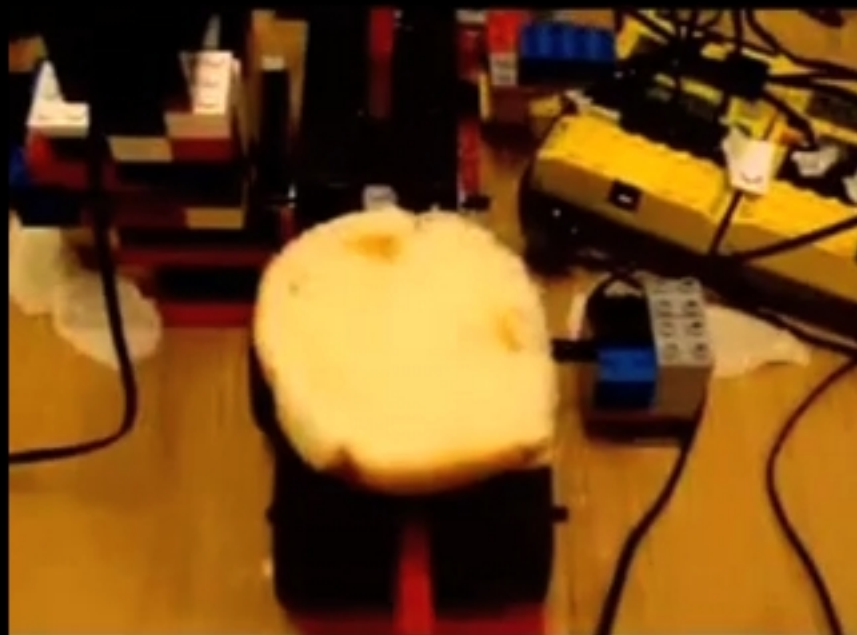
S.A.M. Telling the Imaginary Story



Validation

- *Reflection*
- *Find Evidence*

LEGO Engineering: Swiss Burgers

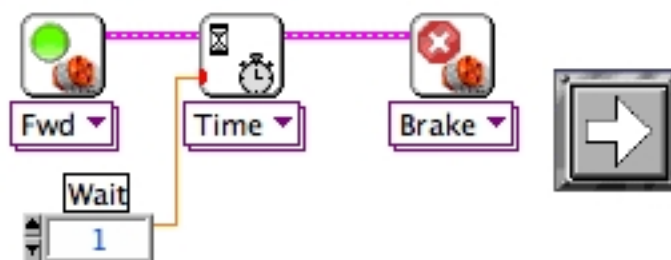
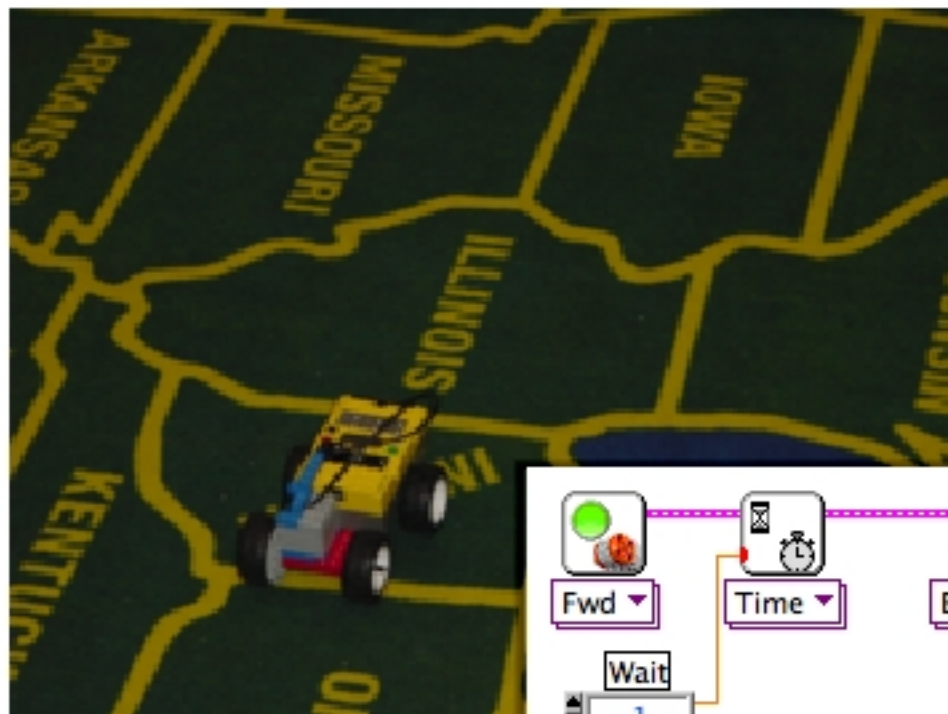


RoboZoo



LEGO Math: Fractions

Controls



Transfer

- *Self-confidence*
- *Innovation*

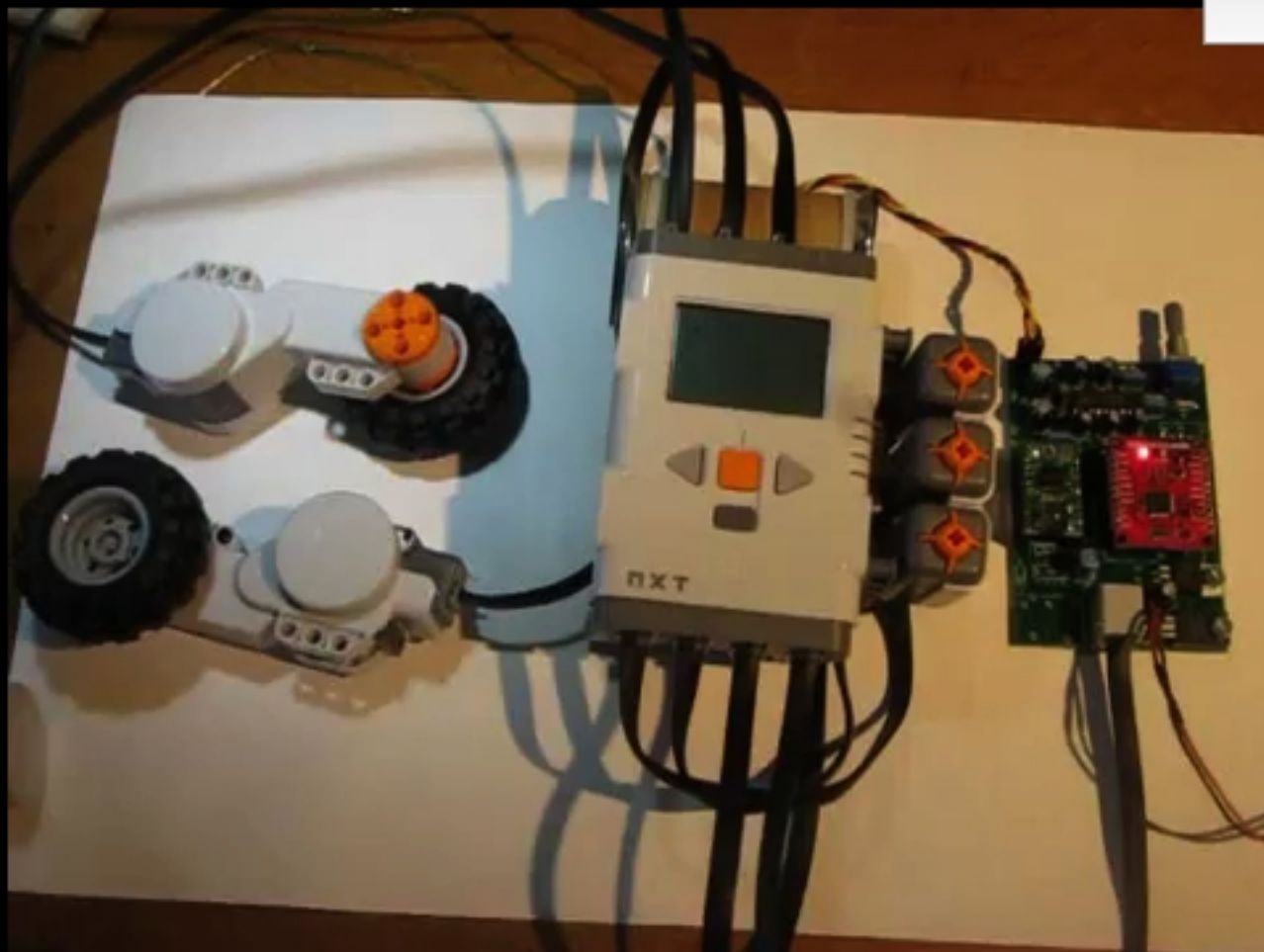
LEGO Engineering: Puppets



LEGO Engineering: Musical Instruments

Demo

Play



LEGOEngineering: Who is it?



LEGO Engineering: Geoff Walkers



Unique Opportunity

- *Help teachers take risks*
- *Promote failure*
- *Remove the answer key*
- *Push for distributed expertise*
- *Listen to the kids*

Kids Can...