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## **Makerspaces: Hands-on, Low-Cost Strategies for Empowering the 4Cs in Students**

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University of Michigan School of Information

Richardson ISD, 11.1.2012, 1-2pm



## Turn and Talk:

Nobody became an educator because they love standardized tests. We become teachers to make a difference in kids' lives.

What kinds of graduates do you want to see?



# We're taking teaching and learning Above & Beyond

Today's students are moving beyond the basics  
and embracing the 4C's — "super skills" for the 21st century!



## Communication

Sharing thoughts, questions,  
ideas, and solutions



## Collaboration

Working together to reach a  
goal — putting talent, expertise,  
and smarts to work



## Critical Thinking

Looking at problems in  
a new way, linking learning  
across subjects & disciplines



## Creativity

Trying new approaches  
to get things done equals  
innovation & invention



For more 4C resources from  
the Partnership for 21st Century Skills,  
including the animated film ABOVE & BEYOND  
by Peter H. Reynolds & FableVision, journey to  
[www.p21.org/4Cs](http://www.p21.org/4Cs)



PARTNERSHIP FOR  
21ST CENTURY SKILLS



<http://www.p21.org/storage/documents/4csposter.pdf>



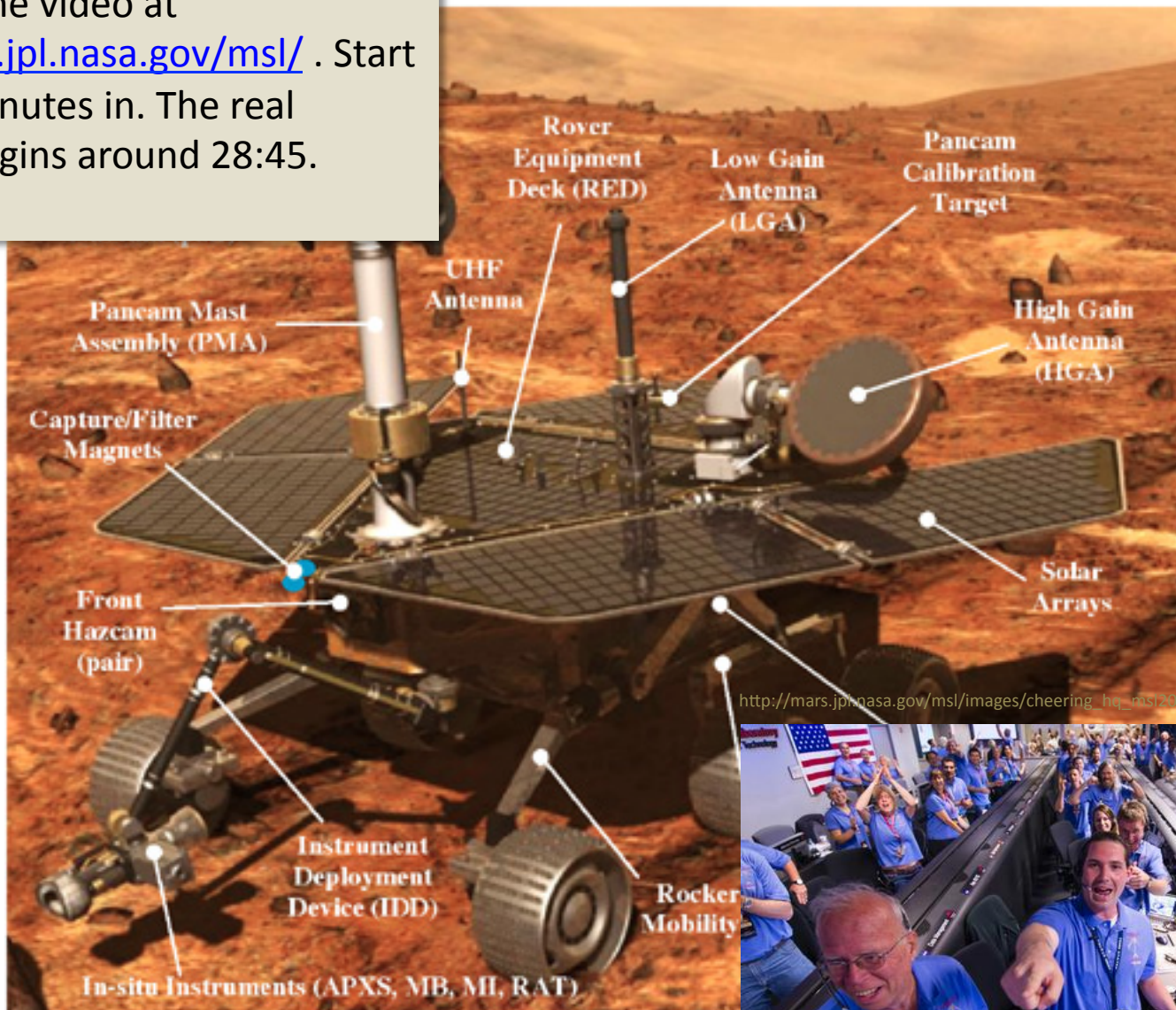
**I'm Excited About ...**



"Smiley Face Stress Ball" by JE Theriot (jetheriot) on Flickr.  
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<http://www.flickr.com/photos/9198432@N02/6101296095>



Watch these engineers celebrate!  
Check out the video at  
<http://www.jpl.nasa.gov/msl/> . Start  
about 25 minutes in. The real  
euphoria begins around 28:45.



[http://mars.jpl.nasa.gov/msl/images/cheering\\_hq\\_msl20120805-hpfeat.jpg](http://mars.jpl.nasa.gov/msl/images/cheering_hq_msl20120805-hpfeat.jpg)



[http://marsrover.nasa.gov/mission/images/rover1\\_detail\\_500.jpg](http://marsrover.nasa.gov/mission/images/rover1_detail_500.jpg)

http://news.cnet.com/8301-11386\_3-57488731-76/google-self-driving-car-300000-miles-and-counting/

CNET News Cutting Edge

# ts Google self-driving car 300,000 miles -- and counting

Company registers progress but cautions of "a long road ahead" (pun intended), especially when navigating snow-covered roadways and interpreting temporary construction signals.



by Charles Cooper | August 7, 2012 4:07 PM PDT

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(Credit: Google)

Google screws around with a lot of far out, even cockamamie projects -- well, because it can and it's fun. Two good reasons that few can fault.

And it's also a good way to push the proverbial tech envelope. So it is that Google's update about the company's [self-driving car project](#) suggests this is turning into something more than Sergey & Larry's homebrew experiment.

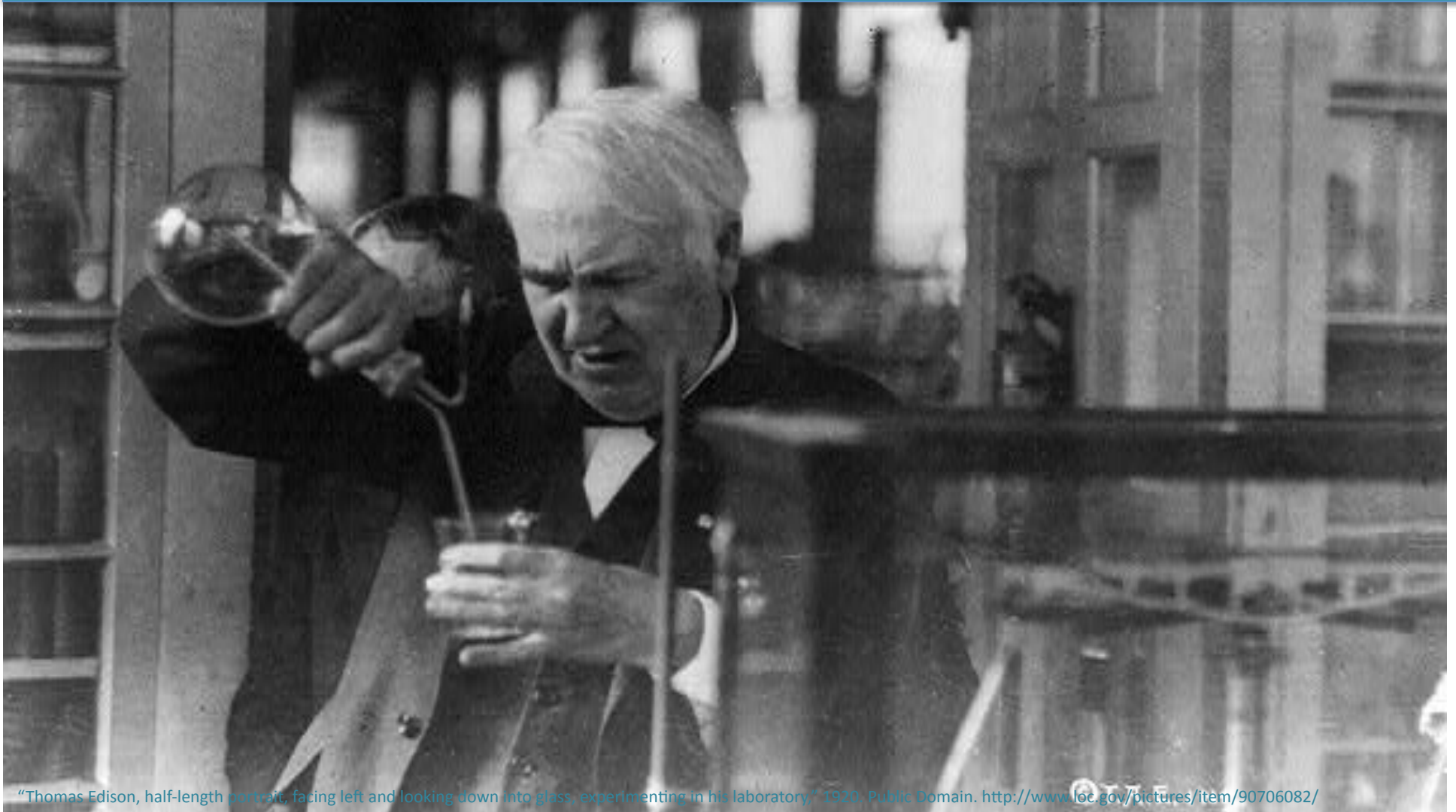
Our vehicles, of which about a dozen are on the road at any given time, have now completed more than 300,000 miles of testing. They've covered a wide range of traffic conditions, and there hasn't been a single accident under computer control.





[http://www.thanedirect.co.uk/products/lifestyle/hughang/Huggable\\_beforeafter.jpg](http://www.thanedirect.co.uk/products/lifestyle/hughang/Huggable_beforeafter.jpg)

# How can we create the next generation of inventors and creators?



"Thomas Edison, half-length portrait, facing left and looking down into glass, experimenting in his laboratory," 1920. Public Domain. <http://www.loc.gov/pictures/item/90706082/>



# Makerspaces are one answer.



"Milwaukee Makerspace – Electroncis Lab" by Pete Prodoehl on Flickr.  
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<http://www.flickr.com/photos/35237092540@N01/5434453002>



# A makerspace is ...

- A workspace with tools and equipment that people can use to stitch, sew, saw, solder, code, mold, cook, laser cut, stitch, etc.
- Similar to: quilt guilds, sewing circles, knitting clubs, hobby groups, etc.
- A way for multiple generations to learn with and from one another
- Tools – Support – Community (Grover)

"Ron's Wooden Gear" by Pete Prodoehl on Flickr.

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<http://www.flickr.com/photos/35237092540@N01/6128718951>





**MICHIGAN** MAKERS

**Our Middle School  
Makerspace**





**MICHIGAN** MAKERS  Fall 2012 Themes



- Pilot program for 20 kids
  - now capped at 40
- 1 school librarian
- 1 faculty advisor
- 8 grad student volunteers
- Once a week, 90 minutes



# MICHIGAN MAKERS

## Introductions





**MICHIGAN** MAKERS

# Squishy Circuits

(A.M. Thomas, U. of St. Thomas)



**MICHIGAN** MAKERS



# Squishy Circuits

(A.M. Thomas, U. of St. Thomas)



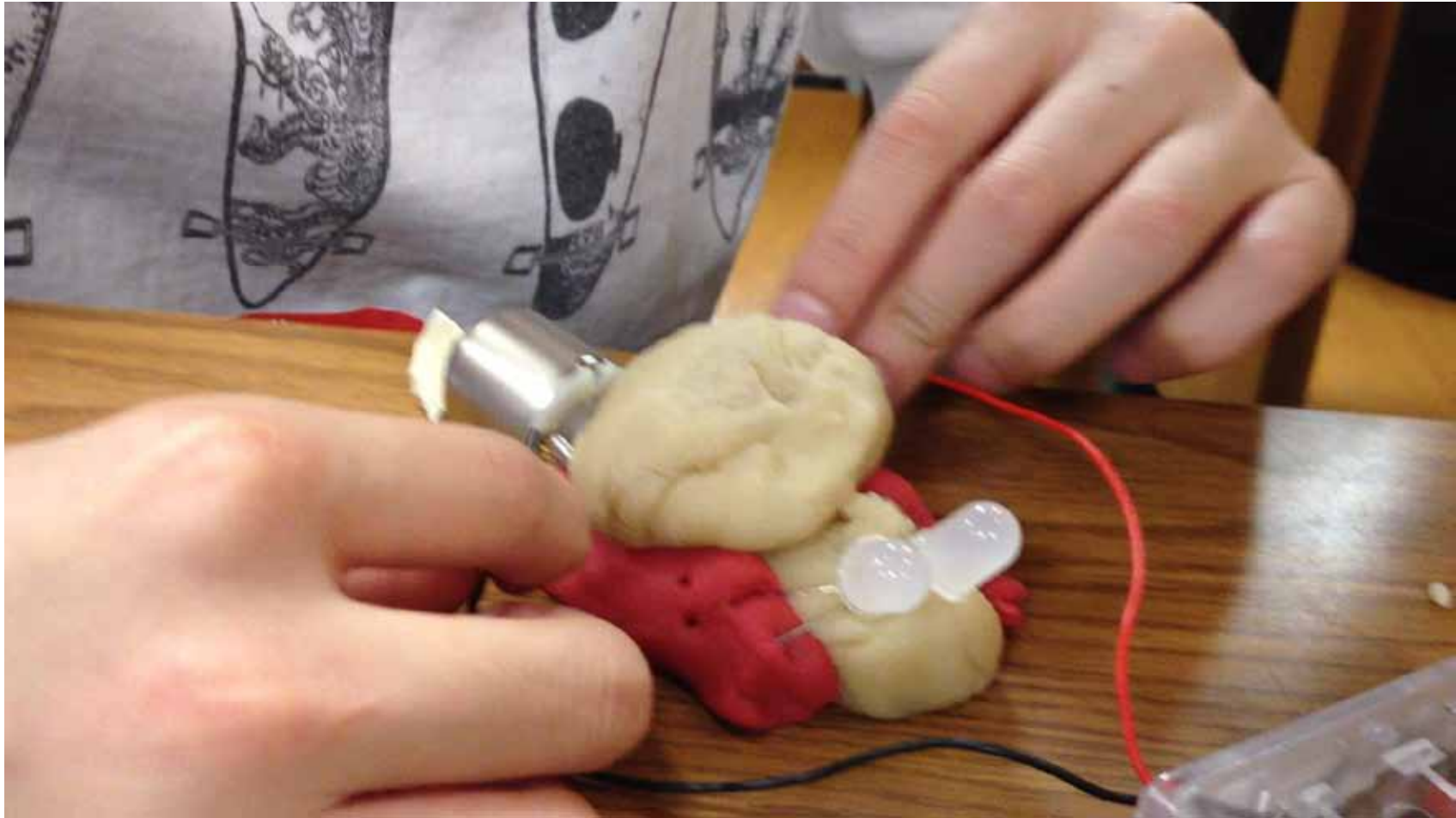


**MICHIGAN** MAKERS

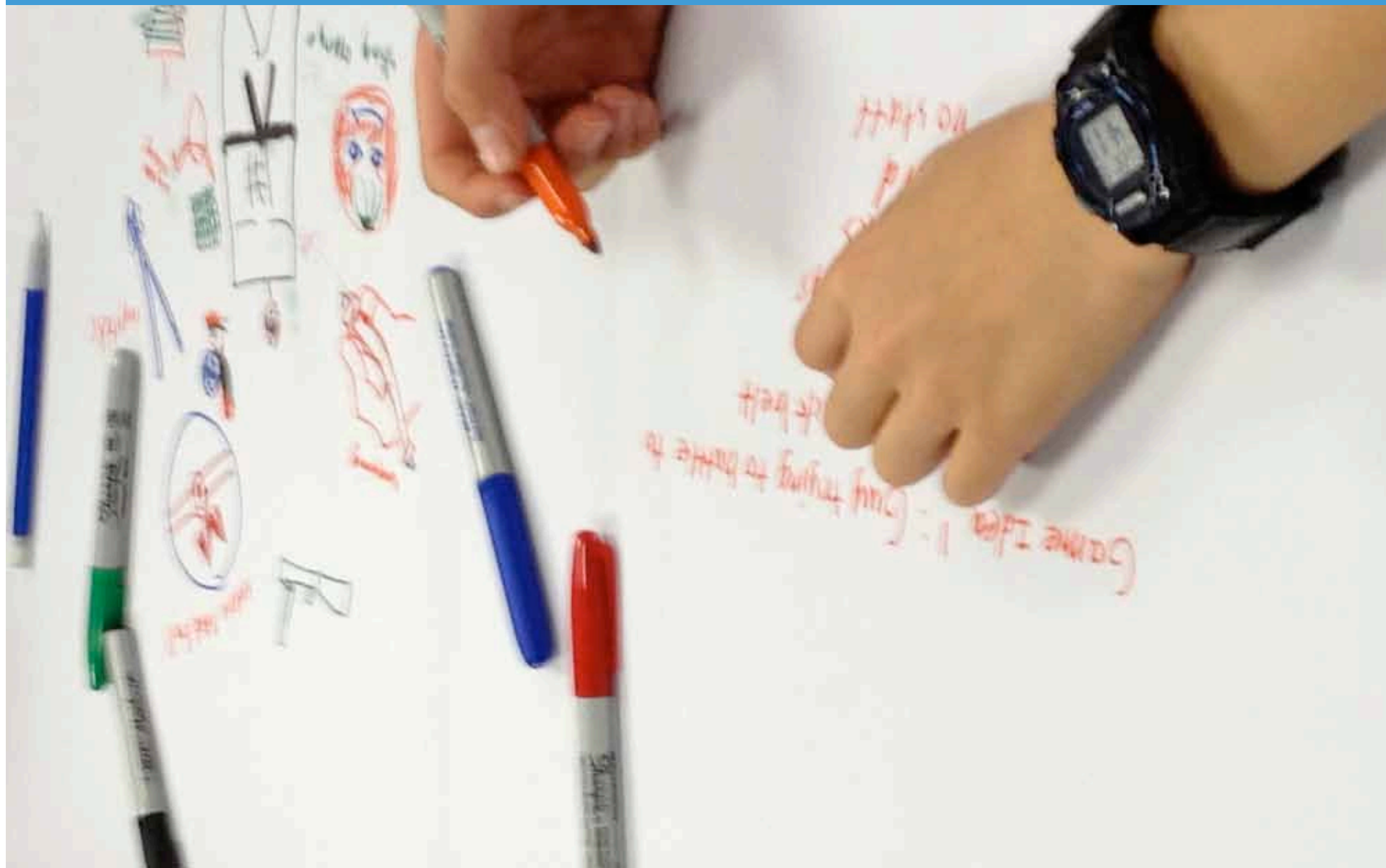


# Squishy Circuits

*(A.M. Thomas, U. of St. Thomas)*



(Click to Play)





What if I made a **GAME**  
with a storyline like **STORY**  
using a theme similar to **Design**

- ⊕ What is the purpose of your game?
- ⊕ Why will people want to play this game and play it again?
- ⊕ Who is this game for?
- ⊕ What is unique about this game...?
- ⊕ What are the big challenges to overcome to make this awesome?





# MICHIGAN MAKERS

## Game Design



**MICHIGAN** MAKERS

Game Design






**MICHIGAN** MAKERS


# Arduino Microcontrollers



 Editor

Basic Edits

- Auto adjust
- Crop
- Rotate
- Exposure
- Colors
- Sharpen
- Resize

 New

Upload Save Share







mozilla ▾

**Editor**   Undo   Redo   T T ▾    Show hints

**Preview for Your Awesome Webpage**   **Publish** >

```
1 <!doctype html>
2 <html>
3   <head>
4     <title>Your Awesome Webpage</title>
5   </head>
6   <body>
7     <p>Make something amazing with the web</p>
8   </body>
9 </html>
```

Make something amazing with the web

[http://  
thimble.webmarker.org](http://thimble.webmarker.org)







# Welcome to badg.us!

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Click here to start:

[\\* Create a new badge](#)

## *what are* **OPEN BADGES?**

*Learning today happens everywhere. But it's often difficult to get recognition for skills and achievements that happen online or out of school. Mozilla Open Badges helps solve that problem, making it easy for any organization to issue, manage and display digital badges across the web.*

*Take the **Badges 101** quiz—and earn your first badge*

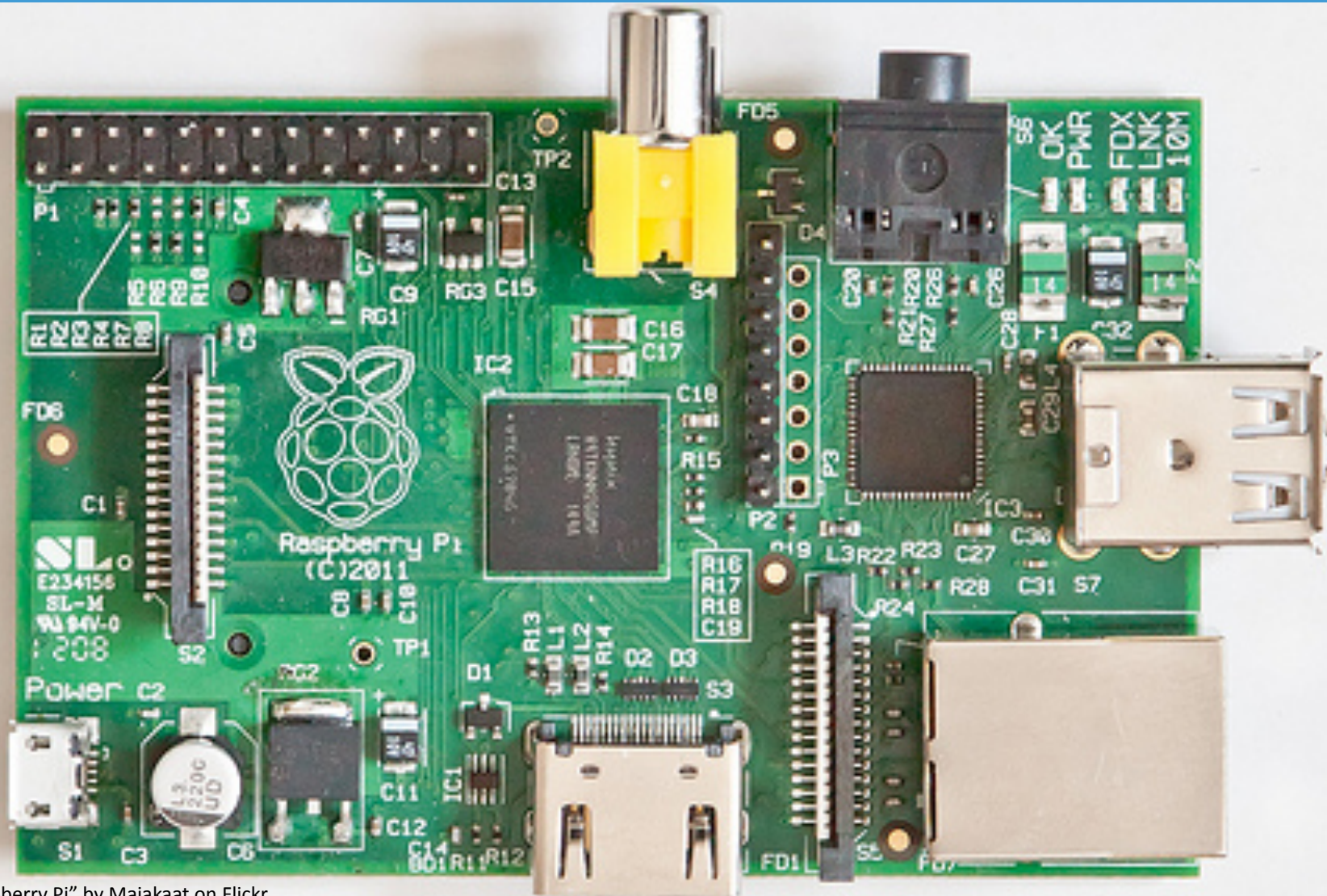
[get started >](#)

[visit your Mozilla Badge Backpack >](#)

Learn more about  
the [DML Badge Competition!](#)







"Front of Raspberry Pi" by Maikaat on Flickr.  
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<http://www.flickr.com/photos/76862456@N07/7046412191>

# MICHIGAN MAKERS

## Raspberry Pi + Scratch or Python or ??

The screenshot displays the Scratch IDE interface for a project named "FortuneCookie". The top menu bar includes "New", "Open", "Save", "Save As", "Share!", "Undo", "Language", "Extras", and "Want Help?". The left sidebar contains various tool categories: Motion, Control, Looks, Sensing, Sound, Numbers, Pen, and Variables. The main workspace shows a script for a character named "gobo" with the following logic:

- When I receive "start\_game":
  - switch to costume "normal"
  - go to x: -170 y: 7
  - wait 1 secs
  - forever loop:
    - if touching "dragon":
      - broadcast "dragon\_hit"
    - if distance to "dragon" < 50:
      - broadcast "breathe\_fire"
    - if distance to "dragon" > 50:
      - broadcast "no\_fire"
    - if touching "fortunecookie":
      - set got\_cookie to 1
      - broadcast "fortune\_hit"
    - if key "up\_arrow" pressed:
      - change y by 5
    - if key "down\_arrow" pressed:
      - change y by -5
    - if key "left\_arrow" pressed:
      - change x by -5
    - if key "right\_arrow" pressed:
      - change x by 5

The stage shows a castle background with a dragon and a cookie character. A "got\_cookie" variable is set to 0. The bottom panel shows a library of assets including "gobo", "dragon", "fortunecookie", "cheetos", "door", "Stage", "YouWon", "YouLost", and "Sprite3".

[http://1.bp.blogspot.com/-4WNM9EiC\\_VU/TgSr02IDUYI/AAAAAAAAAACc/rXzluTmUMuA/s1600/scratch1.png](http://1.bp.blogspot.com/-4WNM9EiC_VU/TgSr02IDUYI/AAAAAAAAAACc/rXzluTmUMuA/s1600/scratch1.png)



- Follow up on anything we've worked on
- Video game programming
- Origami
- Crafts from recycled materials
- Scratch.mit.edu
- Python programming
- Board games
- Self-designed learning

# MICHIGAN MAKERS Measuring Growth

- Journals for Process and Reflection
- Photos and Video
- Badging



# MICHIGAN MAKERS Journal Thoughts

- "Today, we made a pig with lightbulb eyes and a motor tail. We connected the wires to the motor inside the conductive clay and made a series circuit. We outsmarted a college professor!"

# MICHIGAN MAKERS Journal Thoughts

- "I learned that I am better at this stuff than I thought."
- "Today I have been stimulated with the incredible feeling of curiosity."
- "Next week, I want to create the game and see what it is like. I can't wait!"





# MICHIGAN MAKERS Badges to Track Learning

## Badges

### Collecting Badges

Digital badges are a new way to represent learning that happens outside of school. At Michigan Makers, our students receive badges for completing a challenge. They receive badges during meetings in the form of stickers, but they can also be claimed online and used to reflect the kinds of unique knowledge and expertise they have acquired by participating at Michigan Makers.

[Click here to claim your Michigan Maker badges!](#)

### Orientation Badges



I am a Michigan Maker!



I came to Michigan Makers Parent Orientation!

### Squishy Circuits Badges



I helped out a sixth grader!



I Conquered the Squishy Circuits Pig Challenge!

### Game Design Badges



Game Design Pitch-Master





Welcome/  
Orientation



Positive Behavior



New Skills

**If you're not motivated yet, let me  
leave you with this.**

**What if your makerspace helped a  
kid grow up to help someone like  
this does?**

<http://youtu.be/WoZ2BgPVtA0>

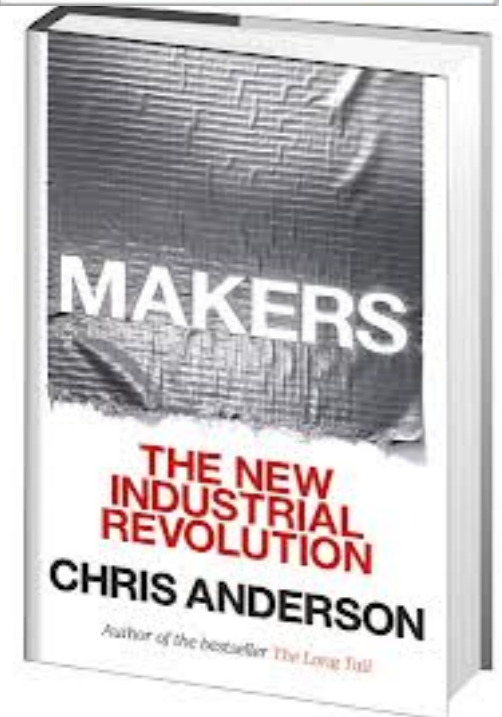
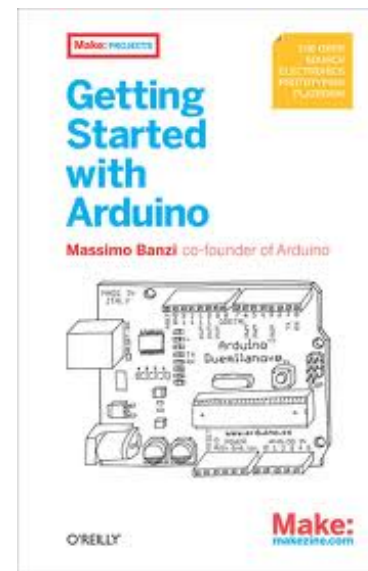


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# Recommended Reading

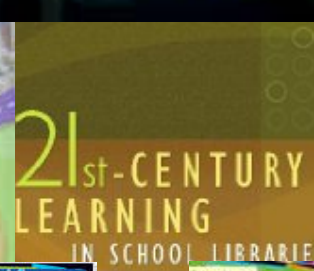
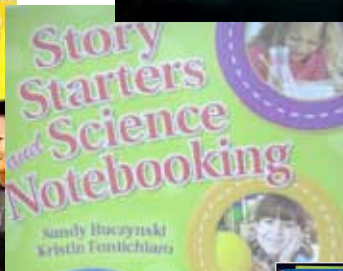
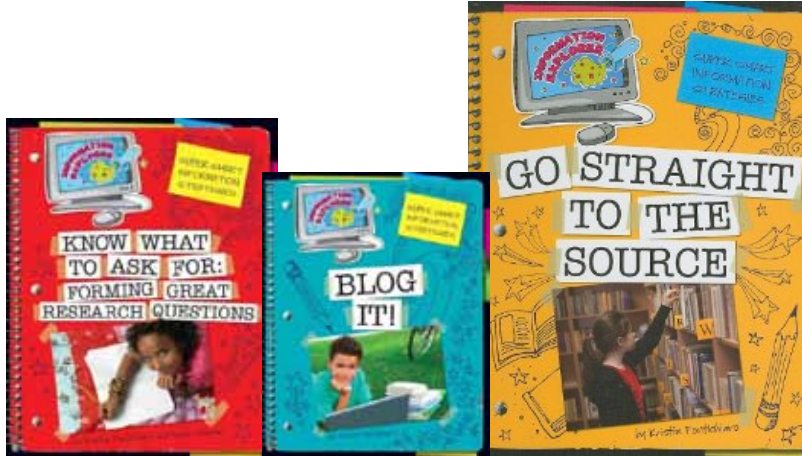
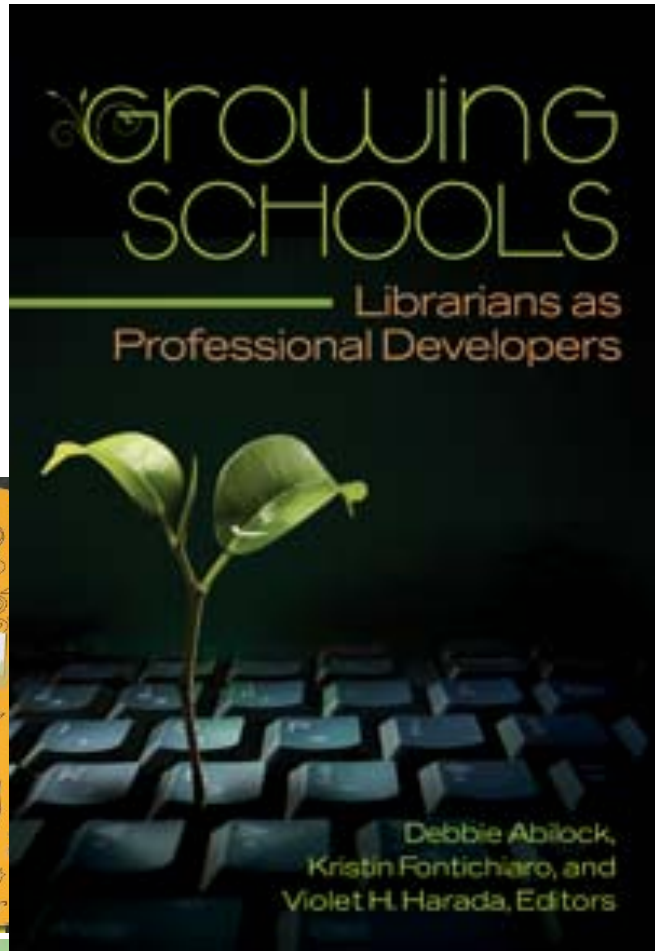
- **Michiganmakers.weebly.com**  
Our makerspace journey
- **Makeread.org**  
The Maker Education Initiative
- **Raspberrypi.org**  
Cool stuff to make with  
Raspberry Pi



# Questions?

font@umich.edu

@activelearning



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