

Resources available at: <https://goo.gl/4rDN8y>

# TOOLS FOR WHO?

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# MAIN POINTS

- Two points:
  1. Students should build things
  2. We need to let our advanced students work with more powerful tools
- Cultural bias against building things runs deep
  - Vo-tech versus “real school”
  - Very early on we bias students toward talking/writing versus making/building/designing

# ACTIVE DESIGN

- Building things is important:
  - It exposes details present in problems that students don't recognize are there when just reading a description
  - It reveals the unexpressed (and unconscious) assumptions that students bring to a problem
  - When a student's built solution fails, it usually reveals the trouble spot directly in the failure
  - Embodying knowledge in artifacts (physical or software) forces students to co-create their understanding (producers versus consumers!)

# ADVANCED STUDENTS

- One of my main concerns is how we train our advanced students
  - We have essentially abandoned them when it comes to software
  - Tools are specialized and domain specific (by topic/curriculum)
  - We artificially limit the students to simple tools which only work for simple problems which hurts their education
- Most of the software we use to teach has training wheels on and we **never** take them off

# ADVANCED STUDENTS

- We have to give the students powerful tools
  - There IS a **cost** to this – more powerful tools are harder to use and take training
  - But the cost is **worth it** in terms of understanding and applicability
- There is also a cultural shift needed
  - Students will resist this!
  - Faculty will resist this, too!

# CONTRAST

- I want to contrast the two extremes in software in education:
  - Demos (toys)
    - Used to show a (single) concept to a class or laboratory
    - Hide details
  - Languages or Extensible Systems
    - Can be used very broadly across topics
    - Exposes details

**My contention is very simple: we need fewer of the former and more of the latter!**

# DEMOS

- Demos are used in math, statistics, and much of science education
  - Teacher-centric - they show one thing and usually hide the details
  - They are focused exclusively on making things **easy** and **engaging**
  - Engagement is mostly defined by **look-and-feel** in demos: **colorful**, **pretty**, **entertaining**, etc.
- While this is one form of engagement, there are others:
  - Treating the students as participants
  - Allowing the students choice in how to do things
  - Giving the students the ability to ask new questions and explore topics of interest to them

# DEMOS

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Languages engage students on these things:

details

gaging

colorful,

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- Treating the students as participants
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# MAIN POINTS

- Two points:
  1. Students should build things
    - **We do not do enough of this**
  2. We need to let our advanced students work with more powerful tools
    - **We depend, even at more advanced levels, on software that is too easy to use, rather than capable of meaningful results**

## EXAMPLE: MONTY HALL PROBLEM

- Player is on a game show:
  - Host shows 3 doors to the player
  - Behind one door is a sports car
  - Behind the other 2 are (stinky) goats
- Play proceeds like this:
  - Player picks a door
  - Host shows a goat (from an un-selected door!)
  - Player gets a chance to switch doors

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Problem:

1. Should the player switch doors?
2. If the player switches doors does this change the chance of winning?

## LINKS TO MONTY HALL GAMES

- <http://www.stayorswitch.com/>
- <http://www.math.ucsd.edu/~crypto/Monty/monty.html>
- [http://www.shodor.org/interactivate/activities/SimpleMonty Hall/](http://www.shodor.org/interactivate/activities/SimpleMontyHall/)
- <http://www.grand-illusions.com/simulator/montysim.htm>
- <http://montyhallpuzzle.appspot.com/>