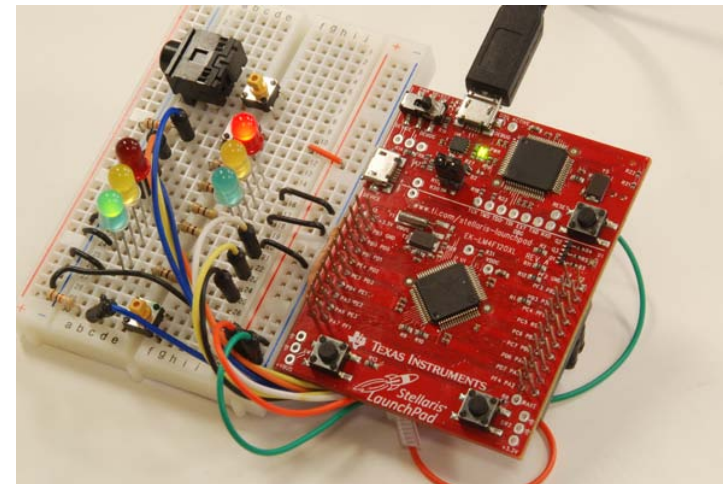
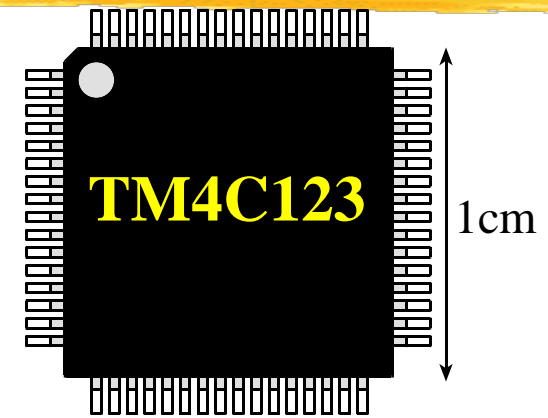


Embedded Systems – Shape the World

- Substantial lab component
 - What, why, learning, assessment
- Embedded Systems
 - Single-chip computer, impact
- Intentionally global
- Peer-to-peer learning
- Industrial partners
- Experiences



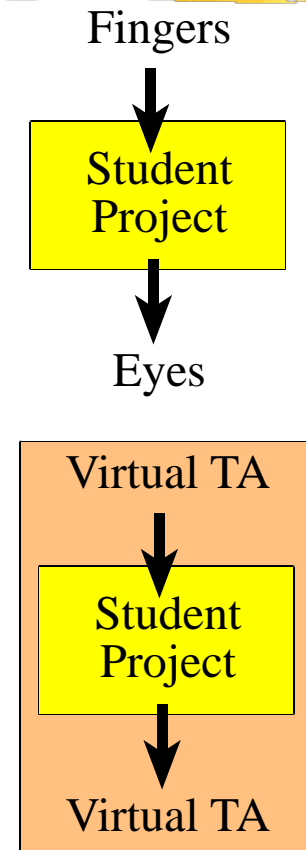
Objectives of offering the course

- Transformational
 - Virtual space is a good first step, but ...
 - Learning occurs by doing
- Outreach
 - Make education accessible
 - Global impact
- Public responsibilities
 - The role of the flag-ship university
 - The pyramid in state-funded education



Substantial Lab Component (90% grade)

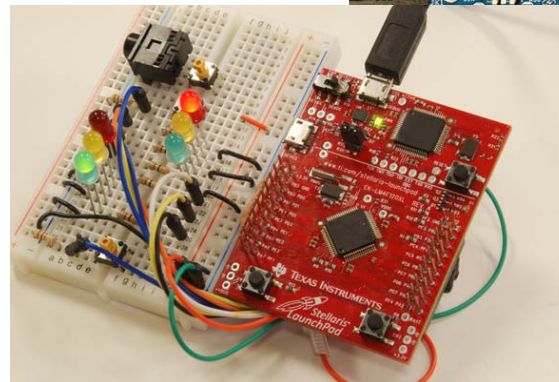
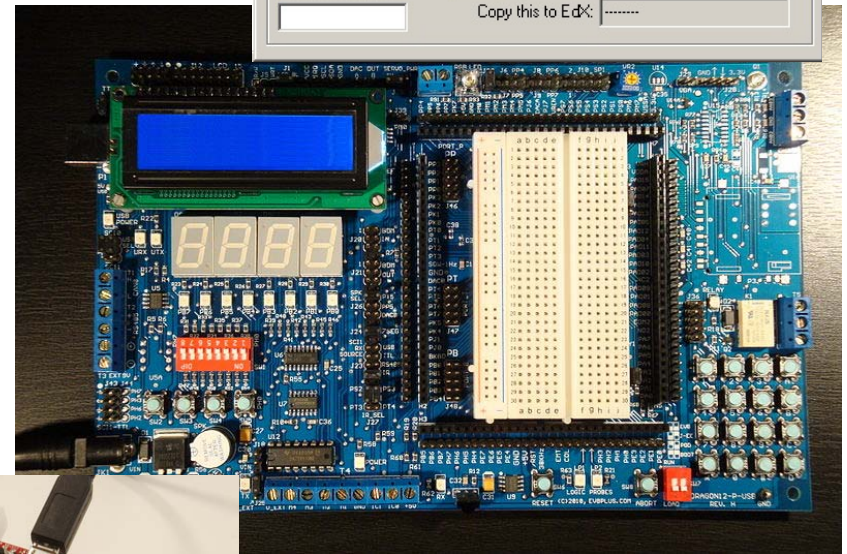
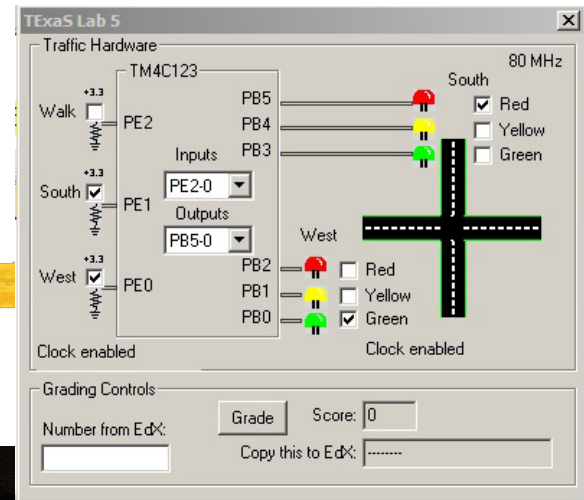
- Necessary Components
 - A sandbox for students to discover
 - *Controllable* by the virtual TA
 - *Observable/gradable* by the virtual TA
- Lab Kit
 - Low cost (\$35)
 - Readily available
- Peer-groups
 - Supports learning (see, do, teach)
 - Provides scaling



We graded function not style

Approaches to Labs

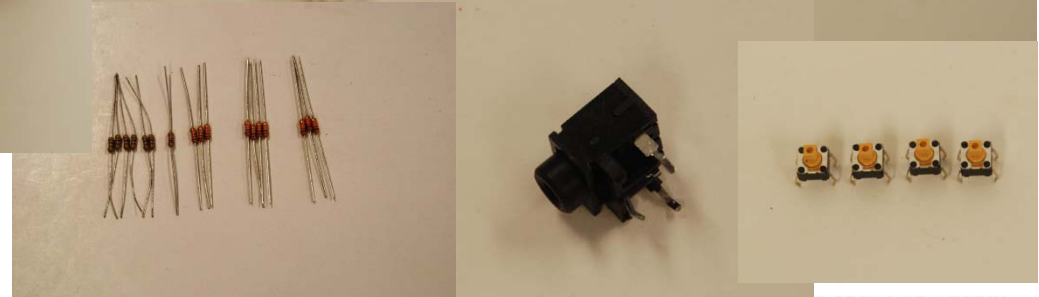
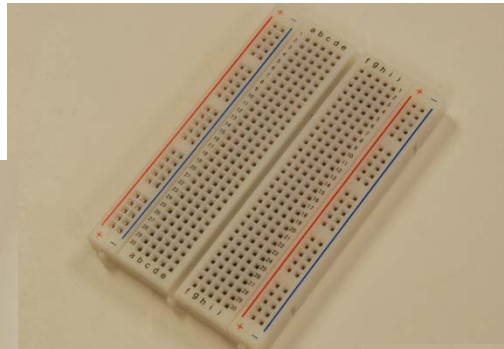
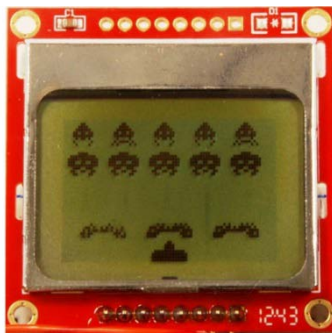
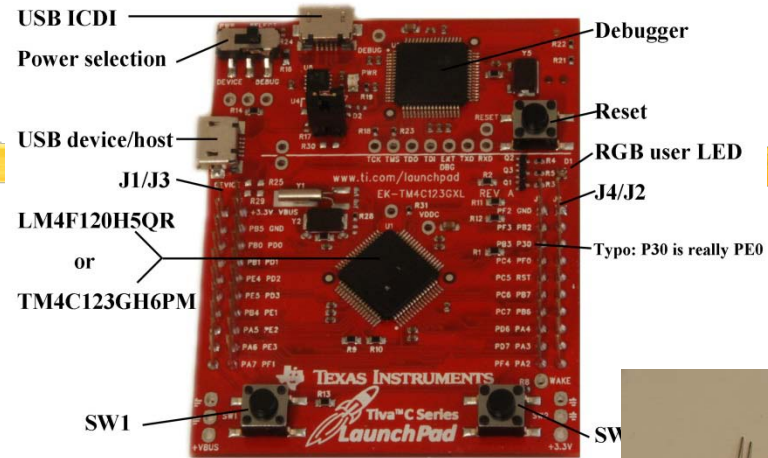
- Simulation
- Full-featured board
- A pile of parts



Jonathan Valvano and Ramesh Yerraballi

Lab Kit

- Board
- Mechanicals
- Electricals
- Display (optional)



Lab Kit

- Low cost
- Available
 - element-14
 - Digikey
 - Mouser
- Easy to buy

Community: edX Embedded Systems Course | element14 - Mozilla Firefox

Community: edX Embedded Systems Course ...

www.element14.com/community/community/knode/dev_platforms_kits/edx

Welcome, Guest Login Register English

My Lists: Parts List | History & Bookmarks

Log in to follow, share, and participate in this community. Not a member? Join Now!

Overview Content People Subspaces and Projects

Get Ready for UT.6.01x!
Embedded Systems - Shape The World

Congratulations on signing up for the University of Texas' *Embedded Systems* online class! All the hardware you need for the class is available below. If you already have some components, just purchase the ones you need. If you're just starting out, no problem! Choose the third option (TIVA C + edX Lab Kit) and you'll be all set for your EdX class.

Good luck from all of us at element14, and have fun exploring the exciting world of embedded systems!

edX

TI TIVA C LaunchPad Buy Now

Texas Instruments Tiva C LaunchPad (EK-TM4C123GXL)

edX Lab Kit Buy Kit

- Everlight Green LED 1.8V 2mA 5mm (x2) Buy Now
- Everlight Red LED 1.8V 2mA 5mm (x2) Buy Now
- Everlight Yellow LED 1.8V 2mA 5mm (x2) Buy Now
- Multicomp Stereo Jack 3pin 3.5mm Buy Now

TI TIVA C LaunchPad + edX Lab Kit Buy Bundle

Texas Instruments Tiva C LaunchPad (EK-TM4C123GXL) Buy Now

edX Lab Kit

- Everlight Green LED 1.8V 2mA 5mm (x2) Buy Now
- Everlight Red LED 1.8V 2mA 5mm (x2)

This effort was only possible with support from Texas Instruments

<http://edx-org-utaustinx.s3.amazonaws.com/UT601x/worldwide.html>

Jonathan Valvano and Ramesh Yerraballi

Lab Kit

The screenshot shows the Aliatron e-Biz website in a Mozilla Firefox browser. The page is for a product titled "Kit para UT.6.01x! Embedded Systems - Shape The World" priced at 47.85EUR. The page layout includes a navigation menu, a category list on the left, a product description in the center, and a list of components. The components listed are:

- Texas Instruments Tiva C LaunchPad ARM Cortex-M4F (EK-TM4C123GXL)
- LED Verde 1.8V 2mA 5mm - 2 unidades
- LED Vermelho 1.8V 2mA 5mm - 2 unidades
- LED Amarelo 1.8V 2mA 5mm - 2 unidades
- Jack estéreo 3,5mm

The product image shows a breadboard with various components connected to a red PCB. The page also features a sidebar with categories, a search bar, and a shopping cart icon.

- Low cost
- Available
- Regional

http://aliatron.pt/e-biz/product_info.php/products_id/1469

Jonathan Valvano and Ramesh Yerraballi

Sandbox for discover Assessment tools

Simulation Grading

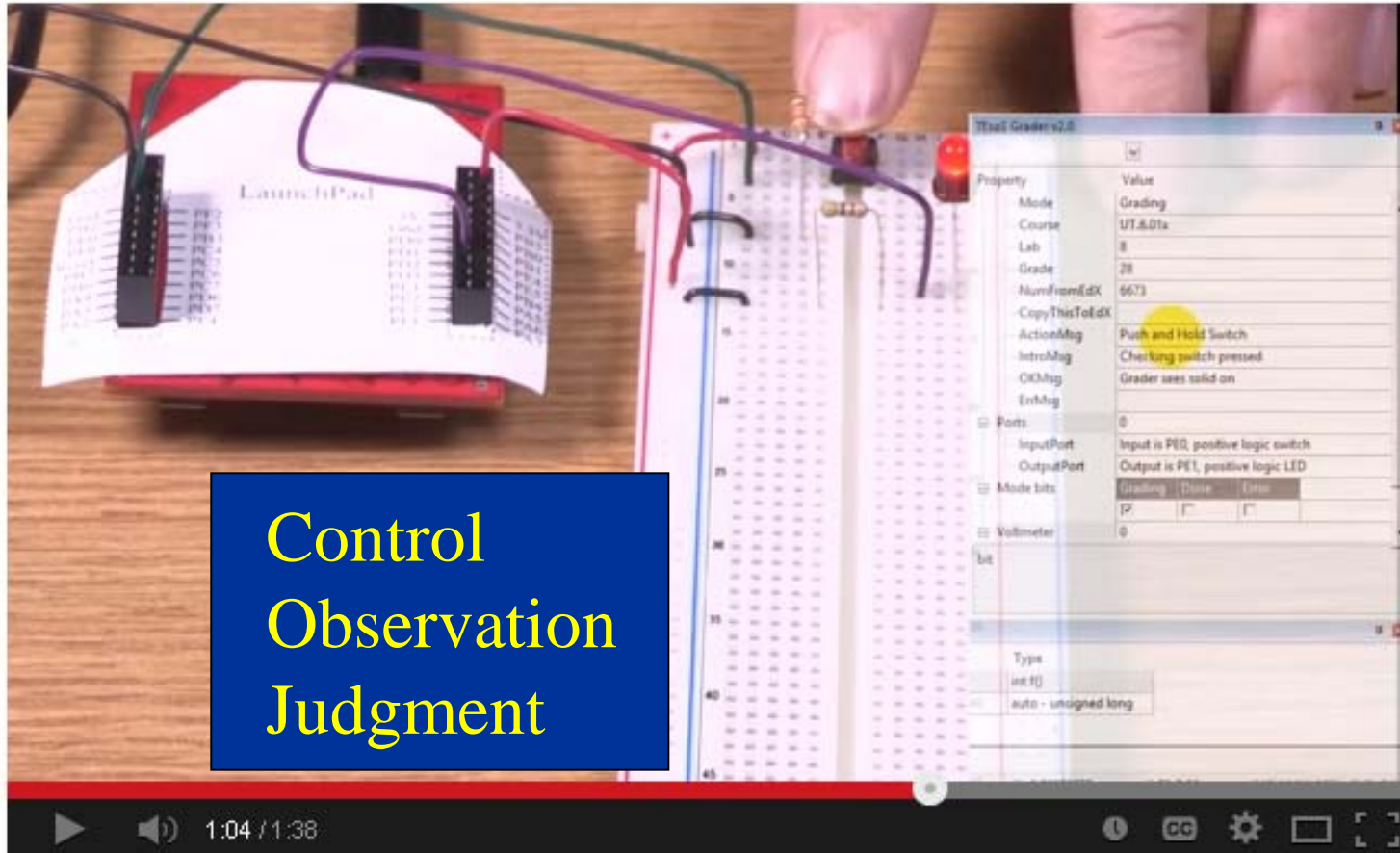
The screenshot displays two windows from a simulation tool. The 'Logic Analyzer' window on the left shows a digital signal trace for 'DACOUT' with a value of 3.300000. Below the trace, a blue box contains the text 'Control Observation Judgment'. The 'TExaS Lab 6' window on the right shows the configuration for a TM4C123 DAC hardware. It includes a 'Binary-weighted DAC' with an 80 MHz clock, a 'DACOUT' output, and a 'Headphone' output with a 32 ohm resistance. The DAC is configured with a 'Clock enabled' setting. The 'Grading Controls' section at the bottom right shows a 'Grade' button, a 'Score' field with the value 0, and a 'Copy this to EdX' field.

We graded function not style

Jonathan Valvano and Ramesh Yerraballi

Real Board Grading

Sandbox for discover
Assessment tools



http://youtu.be/5KI1_eMCT38

Jonathan Valvano and Ramesh Yerraballi

Embedded Systems – Shape the World

USA	20.2%
India	18.0%
UK	5.4%
Spain	4.0%
Brazil	3.4%
Pakistan	3.2%
Colombia	2.9%
Russia	2.8%
Mexico	2.5%
Egypt	2.3%
Canada	2.2%
Poland	2.0%
Greece	1.8%
Germany	1.4%
China	1.2%
Ukraine	1.2%

4682 out of 34,187 Registrations

France	1.1%	Asia	27.4%
Australia	1.1%	Europe	26.1%
Bangladesh	1.1%	North America	25.0%
Turkey	1.0%	South America	10.3%
Argentina	1.0%	Africa	4.5%
Hungary	0.9%	Middle East	2.7%
Portugal	0.9%	Southeast Asia	1.7%
Italy	0.9%	Oceania	1.3%
Peru	0.9%	Central America	1.0%
South Korea	0.2%		
Japan	0.2%		
New Zealand	0.2%		
Venezuela	0.1%		

Embedded Systems – Shape the World

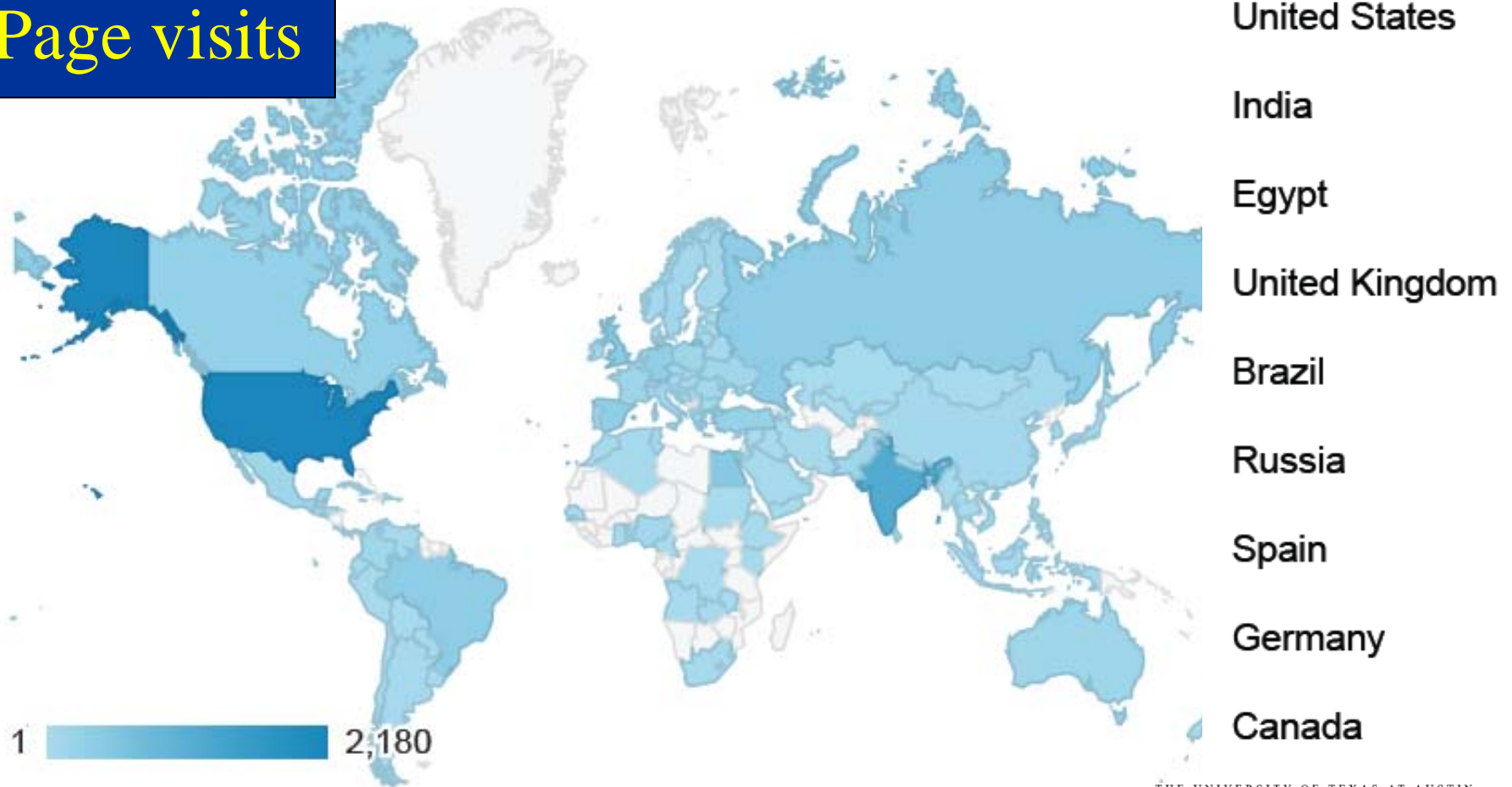
Forum posts



Jonathan Valvano and Ramesh Yerraballi

Embedded Systems – Shape the World

Page visits



Jonathan Valvano and Ramesh Yerraballi

World Wide Reach

- Language
 - In English
 - Needs Multilanguage transcription/caption
- Lab Kit
 - Cost
 - Availability
- Internet Speed
 - Needs multiple resolutions
 - Ability to download then watch

Male 24851
Female 2769

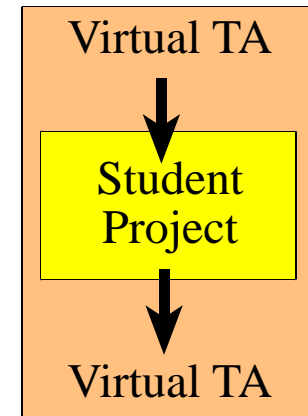
Age	Count
10 to 19	1232
20 to 29	16835
30 to 39	3389
40 to 49	2156
50 to 59	926
60+	383

Results, 7 days after launch

- 35775 enrolled
- 9000 kits sold in January, 2000 in December
- 10716 finished the first quiz
- 3925 finished the first lab in simulation
- 3065 finished the first lab on the real board

My Thoughts

- MOOC Lab needs ability to control, observe, assess
 - Needs more creativity and open ended
 - Needs more qualitative assessments
- Peer interactions are critical
 - Teams of 2 or 3
 - Helping each other in forums
 - Cohort of 20 to provide qualitative feedback
- Industry collaboration is essential
- Can't do enough beta-testing
- It's education but not ready for college credit
- It takes a village



Can you be lonely in a class of 36,000?

Jonathan Valvano and Ramesh Yerraballi