The Future of Robots in Education: Revaluing the Concrete

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Learning by Watching

Ready to learn computer programming but aren’t sure where to start? Look no further, Computer Programming for Teens is the book for you. Other books on programming tend to be language specific and often get bogged down in the syntax of the language. That is fine if you already have a strong background in programming, but if you’re a novice, the language-specific approach can make things unnecessarily difficult.
From Feb ’09 CACM

• This is from an article entitled “Human Computing Skills: Rethinking the K–12 Experience”

• “Programming is to CS what proof construction is to mathematics and what literary analysis is to English.”

• “Substantial preparation in computational thinking is required before students enroll in programming courses”
On the other hand... from Papert’s *Mindstorms*:

Although the thought experiment of imagining a Mathland leaves open the question of how a Mathland can actually be created, it is completely rigorous as a demonstration that the accepted beliefs about mathematical aptitude do not follow from the available evidence. But since truly mathophobic readers might have trouble making this experiment their own, I shall reinforce the argument by casting it in another form. Imagine that children were forced to spend an hour a day drawing dance steps on squared paper and had to pass tests in these “dance facts” before they were allowed to dance physically. Would we not expect the world to be full of “dancophobes”? Would we say that those who made it to the dance floor and music had the greatest “aptitude for dance”? In my view, it is no more appropriate to draw conclusions about mathematical aptitude from children’s unwillingness to spend many hundreds of hours doing sums.

One might hope that if we pass from parables to the more rigor-
Sherry Turkle’s “Falling for Science”

Boys and their toys?

or

deep and profound relationship between scientists and their tools
Artbotics.org: NSF BPC project
Holly Yanco, Fred Martin, Hyun Ju Kim, Linda Silka (UMass Lowell)
Diana Coluntino, Diane Testa, Jerry Beck (Revolving Museum)
Connecting Computing
to the Fine, Performing, and Design Arts

NSF CPATH: Jesse Heines, Fred Martin, Sarah Kuhn, Jim Jeffers, Gena Greher, Nancy Selleck, Karen Roehr

Undergrad multi-disciplinary gen-ed and “synchronized” upper level course collaborations

• Tangible Interaction Design • Sound Thinking
• Theater Software • GUI Programming and Web Design
NSF ITEST: Fred Martin, Doug Prime, Michelle Scribner-MacLean (UMass Lowell) Sam Christy, Ivan Rudnicki (Machine Science)
iSENSE: NSF ALT

Fred Martin, Michelle Scribner-MacLean, Sarah Kuhn (UMass Lowell)
Sam Christy, Ivan Rudnicki (Machine Science)

**iSENSE and SunSPOTS**

iSENSE uses remote SunSPOTs to record and store data from various external sensors that is later uploaded as an experiment on iSENSE.

The SunSPOTs can be used as a store and forward device, wireless collector that instantly forwards data, or remote collector that only sends data when asked to.

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**SunSPOTs in Action!**

**Merrimack Water Quality**

- Performed by Professor Sarah Kuhn's Design for a new World class, PH levels in the Merrimack river were recorded using SunSPOTs and external sensors.

**John's Walk Home**

- iSENSE developer tests an external GPS sensor on the SunSPOT by recording his walk home from work.

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Students at The University of Massachusetts Lowell developed an external sensor board to connect to the SunSPOT. The board, pictured above, connects to the external pins on the eDemo board on the SunSPOT. It provides a GPS device, BTA connector for Vernier devices, and two Analog sensor headers.
Visualization for Experiment #120: Soil Contamination Experiment - Petroleum

9 Sessions Added.

Session #5360: Methuen - Abandoned Gas Station
GPS Coordinates: (42.72711, -71.201697) [focus]

Session #5361: Methuen - Dept. Public Works Lot
GPS Coordinates: (42.7245779, -71.2018272) [focus]

Session #5362: Methuen - Playground
GPS Coordinates: (42.7224667, -71.1749615) [focus]

Session #5363: Lawrence - Apartments
GPS Coordinates: (42.71304, -71.16354) [focus]

Session #5364: Lawrence - William Kennedy Community Park
GPS Coordinates: (42.7133917, -71.1740239) [focus]

Session #5365: Methuen - Newer Residential Development
GPS Coordinates: (42.715687, -71.239626) [focus]

Session #5366: Lowell - North Campus Playground
GPS Coordinates: (42.654934, -71.326035) [focus]

Session #5367: Lowell - Hadley Field Playground
GPS Coordinates: (42.6353847, -71.3512175) [focus]

Session #5368: Methuen - Newer Residential Development
GPS Coordinates: (42.713258, -71.240693) [focus]
Embedded Computing and Authentic Inquiry in Middle School Science
NSF Career Fred Martin with Sachiko Tosa

It's a temperature sensor, or is it…
- a refrigerator performance sensor
- a heated fluid lipid detector
- a thermal diffusion detector
- a breath rate detector
- a heating pad efficacy sensor
- a wet suit performance sensor

Teachers’ questions…
These sensors are uncalibrated! How can I trust anything about them?

It's a light sensor, or is it…
- a football rotation sensor
- an automobile sensor (headlights)
- a persons-entering-the-room sensor
- a human/animal leg gait sensor
- a solar energy and cloud detector
- a late-night snack detector

Research questions…
How can I make sense of this data—(what version of reality does it represent?)

It's a touch sensor, or is it…
- a reaction time sensor
- an event marker trigger

Why is there noise in my data? How can I get rid of it?

A rotating football w/light sensor—graph shows release, rise, rotation, fall, catch, and 60 Hz. florescent light flicker.

As teachers' notions of inquiry change, how does that of their classroom practice?

How does student learning change as a result of teachers' changing practice?
Robot controllers are everywhere…

- Basic Stamp, LEGO RCX, LEGO NXT, Pololu Orangutan, Handy Cricket, Super Cricket, Pico Cricket, Arduino, Basic Atom, GumStix, XBC, XBoard, Qwerk, Butterfly, PolyBot, MinilTX, etc., etc., etc.

Robots too…
Broadening the Appeal:
More Kinds of Design

- mechanical - architectural - geometrical
- circuits - signals - flow - sensors
- code - sequence - data
Broadening the Appeal: More Applications
keys to success

• informal learning (after school) — clubs, contests, other activities — to get them in the door

• flexibility and richness in undergraduate curricula (gen ed slots) — applications that matter (ricc.wpi.edu)

• revaluing the concrete — changing culture so we’re not afraid to play with toys at all levels