Learning by Making at BeAM

- What is Making?
- Where are we?
- Examples for teaching: Nanotechnology, Radios , Music
- Neuroscience/Microscopy Teaching – Vladimir Ghukasyan

Danianne Mizzy (KSL)
David Romito (KSL)
Therese Triumph (KSL)

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Vladimir Ghukasyan
Neuroscience

UNC Neuroscience Center

Richard Superfine (Physics/Astro)
Michelle Garst (BeAM)

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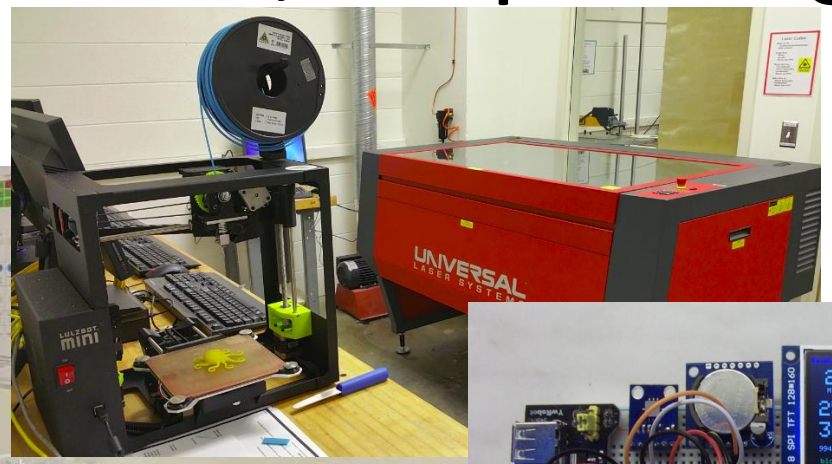
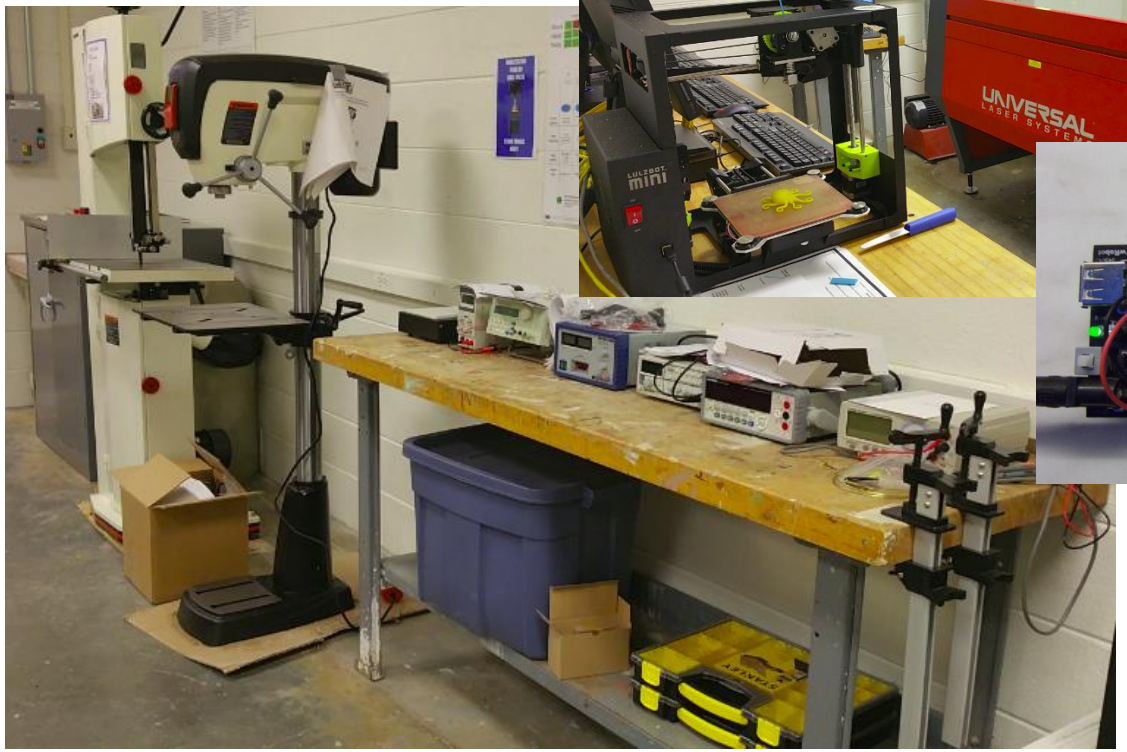
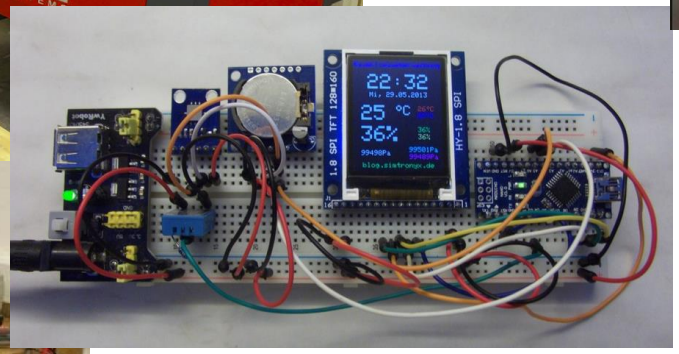
What is Making?

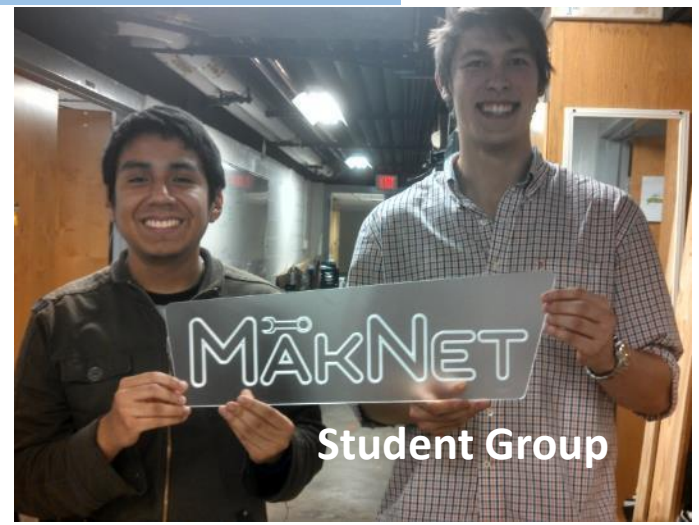
- Things! Materials, Electronics, Sensors, Motors, 3D printing

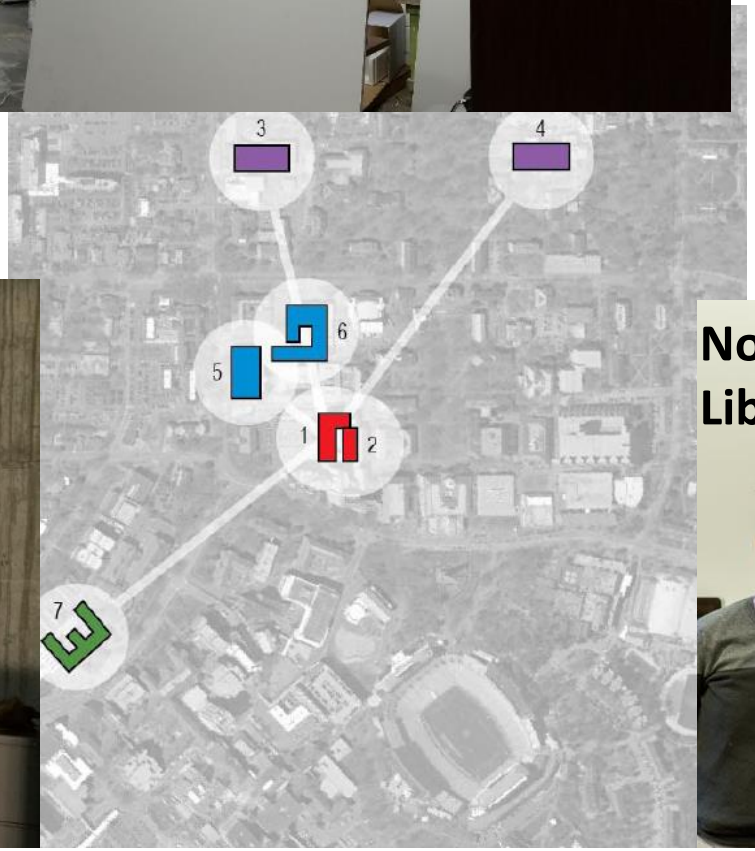




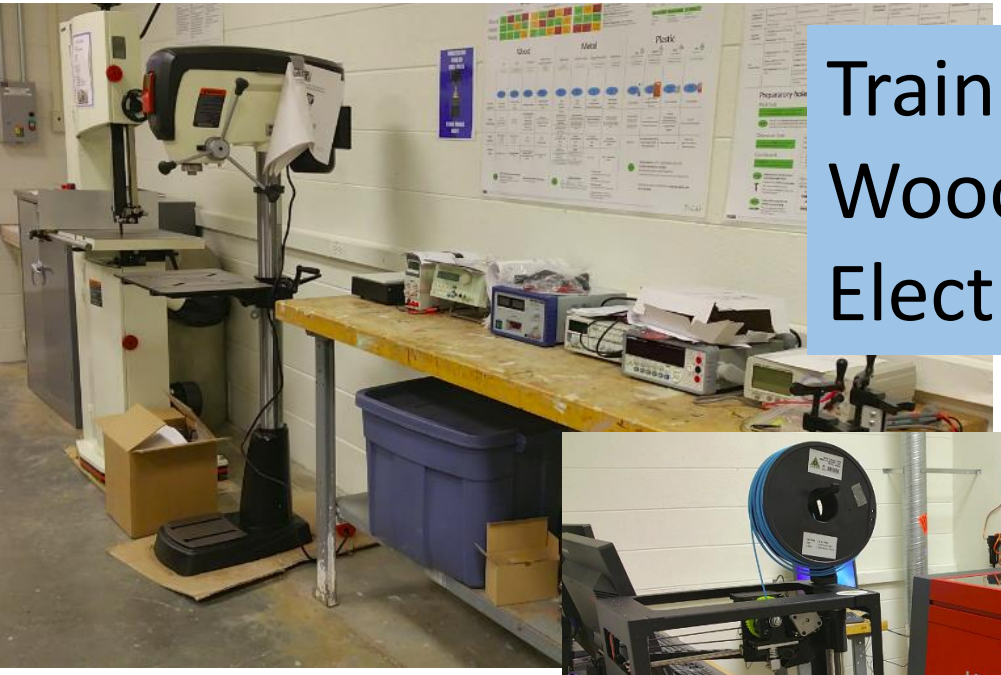


Where are we?: BeAM@

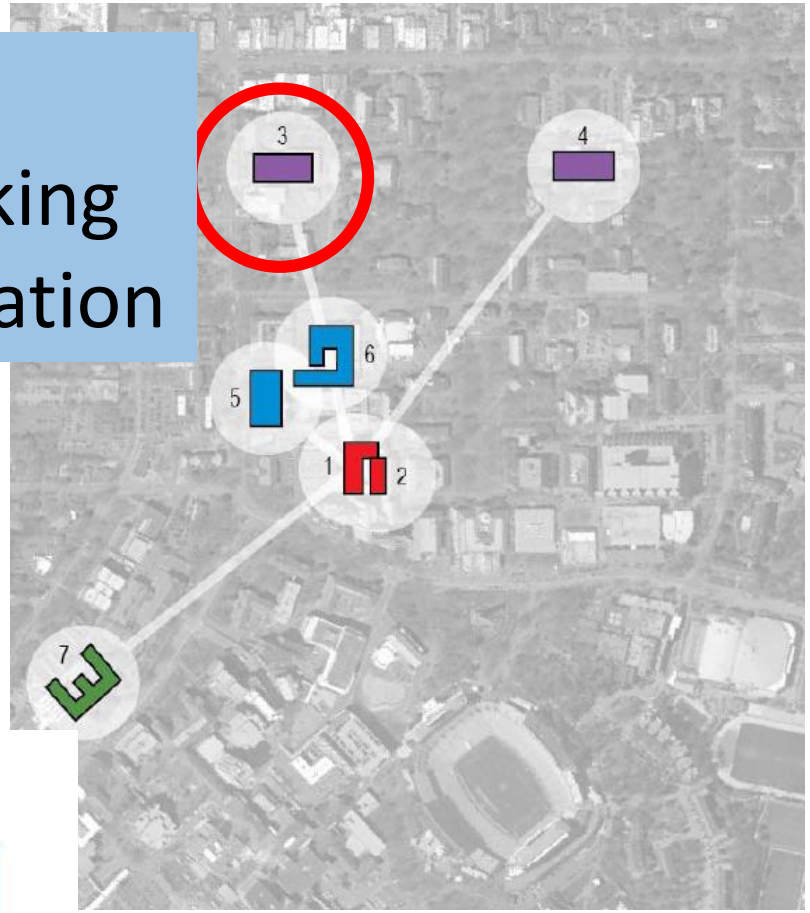




Where are we?: BeAM@Hanes Art Center



Training, Workshops
Wood/Plastic/Metal working
Electronics, Digital Fabrication



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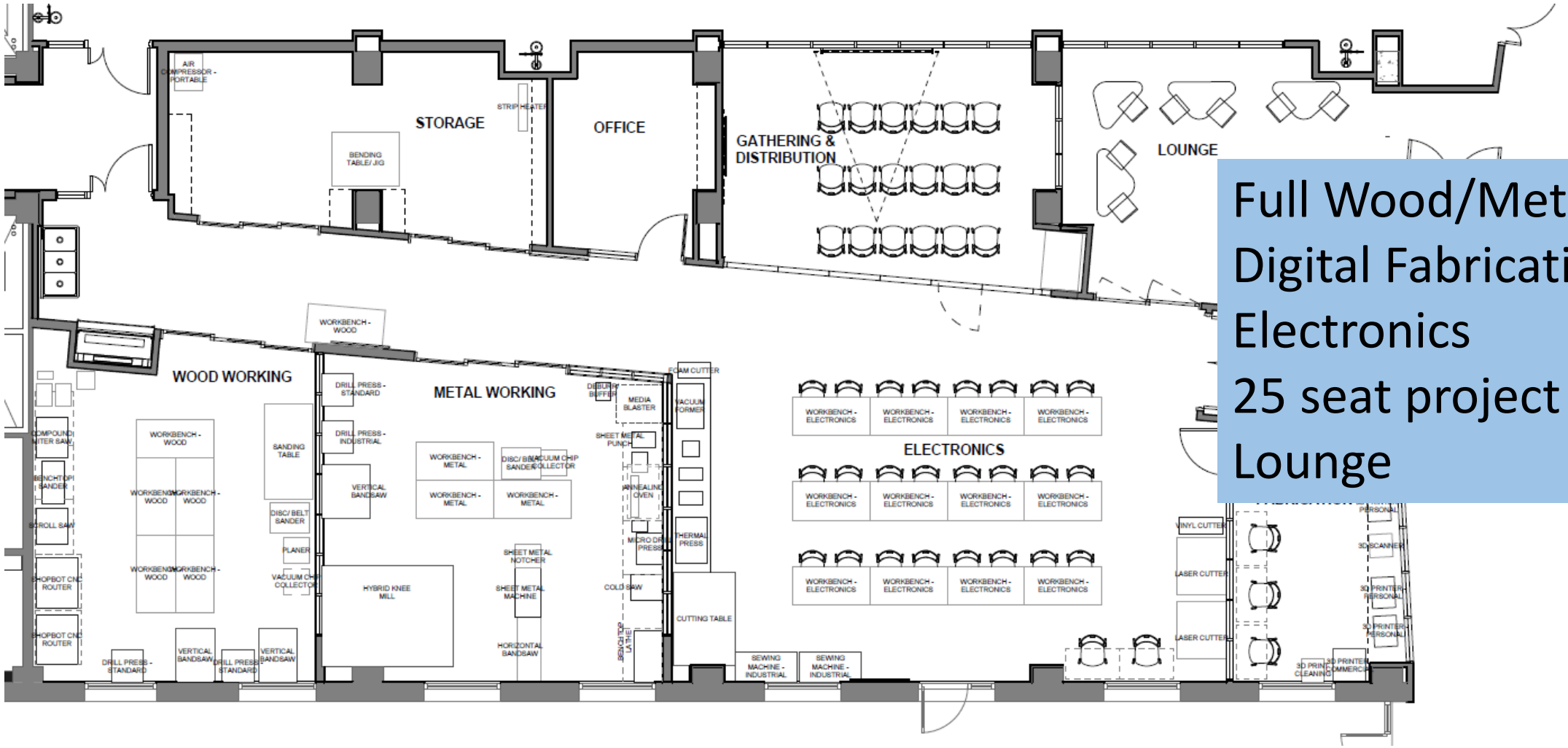
Where are we?: BeAM@Murray Hall (4/2016)



Full Wood/Metal shops
Digital Fabrication
Electronics
25 seat project classroom
Lounge

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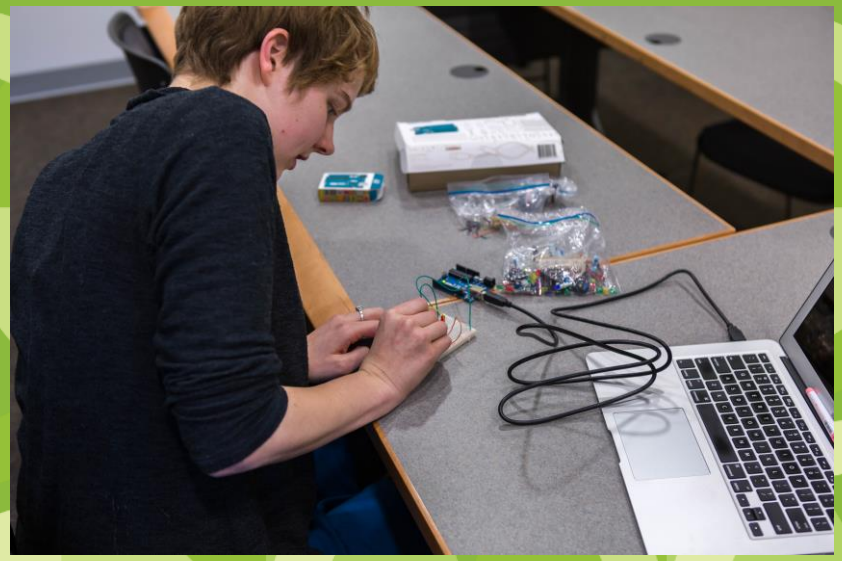
BeAM@KSL Makerspace

3D Design Consultations

3D Printing, 3D Scanning, Arduino, Sewing

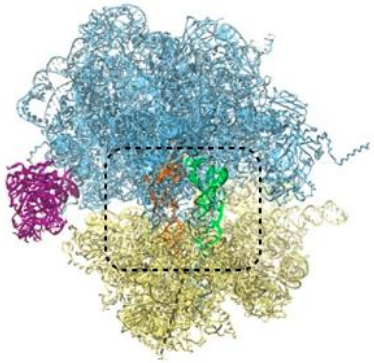
Workshops & Course-integrated instruction

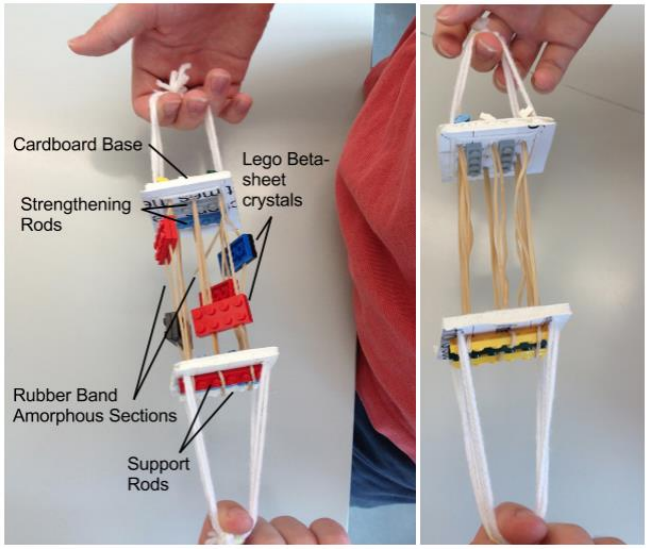
Course Integrated Instruction
ECON 325: Entrepreneurship: Principles and Practice
JOMC 585: 3D Design Studio
ECON 327: Commercial Venture Creation
ARTH 089: First Year Seminar on Islamic Art and Science
NBIO 890: Special Topics in Neurobiology: Microscopy Methods in Neurobiology
ARTS 300: Studio 15: Art Majors Seminar
JOMC 585: 3D Design Studio

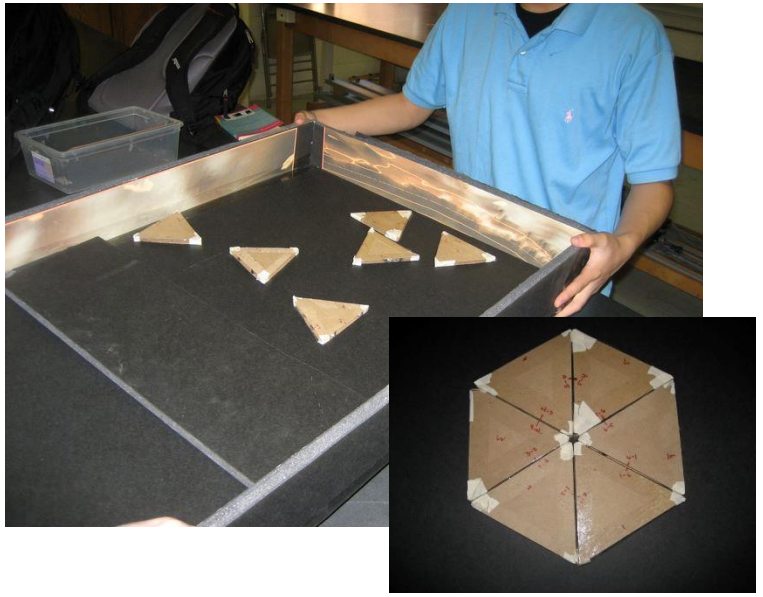


Making for First Year Seminar: Mike Falvo (Physics/Astro) Pedagogy and Evaluation

- PHYS 53.001: Handcrafting in the Nanoworld: Building Models and Manipulating Molecules
- Structure – models of proteins/complexes
- Dynamics – modeling processes
- Function – Mechanical model







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Making for First Year Seminar: Mike Falvo (Physics/Astro) Pedagogy and Evaluation

"You first see really basic representations, then next more complicated, and on up to the real thing. This is an effective progression [for teaching] because if I saw the microscopes [pictures] right away I'd have been confused."

"It [the course content] is not simplified, but it helps to build the model and visualize what is going on."

Journal of
Nano Educa
Vol. 5, 1–9, 2

Nanoscience for All: Strategies for Teaching Nanoscience to Undergraduate Freshmen Science and Non-Science Majors

Thomas R. Tretter[1,*], M. Gail Jones[2], and Michael R. Falvo[3]

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Journal of
Nano Education
Vol. 2, 53–66, 2010

Impact of Introductory Nanoscience Course on College Freshmen's Conceptions of Spatial Scale

Thomas R. Tretter[1,*], M. Gail Jones[2], and Mike Falvo[3]

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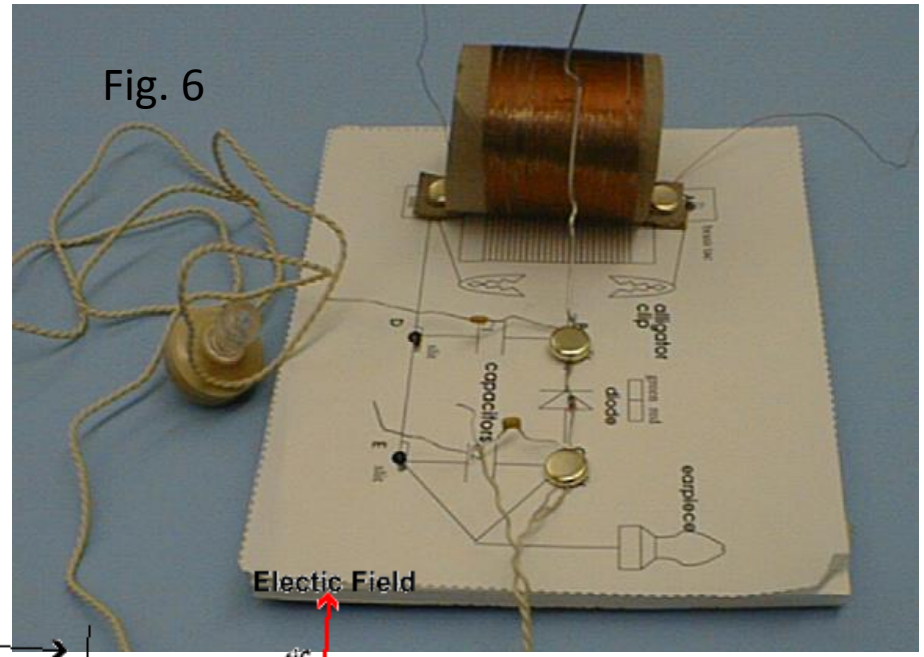
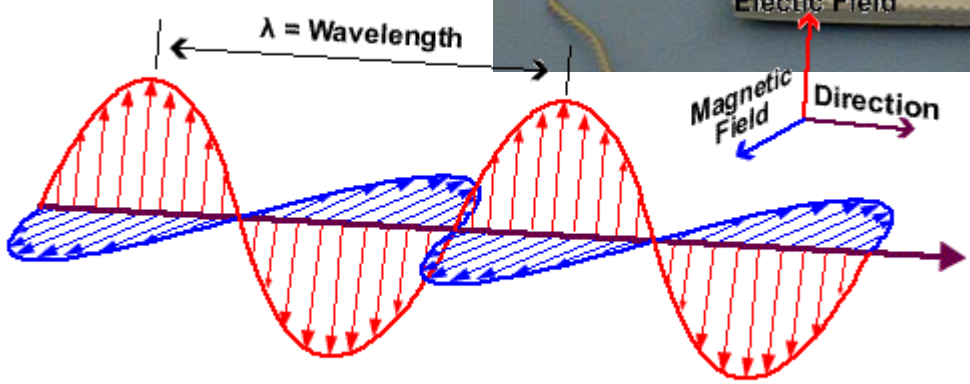
Making for 100+ classes

- Making = active learning – for all classes
- How to make the abstract real

Physics 100: How Things Work
125 students-NonScience Majors!
Everyone – crystal radio kit
Wire, diode, earpiece :3$/kit





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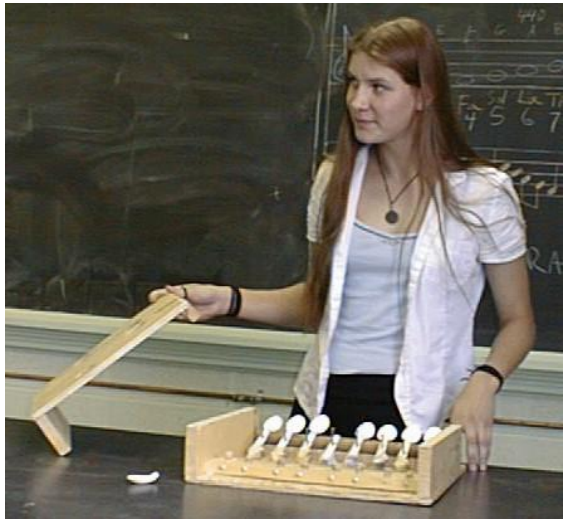
Making Music: The Interplay of Physics and Music

- FYS taught by Laurie McNeil (Physics/Astro) & Brent Wissick (Music)



How do you use it for teaching?

- Classes – entirely or in sections
  - Physical Computing (entirely): Sp'17
  - NeuroScience Microscopy (4 sections):Sp'15
  - Course Development grants – coming soon…
- Training in software – current calendar, we come to you!
- Training in use of spaces/tools – ongoing, customized for you
- Open project time in space for out of class experiences.

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The Challenge

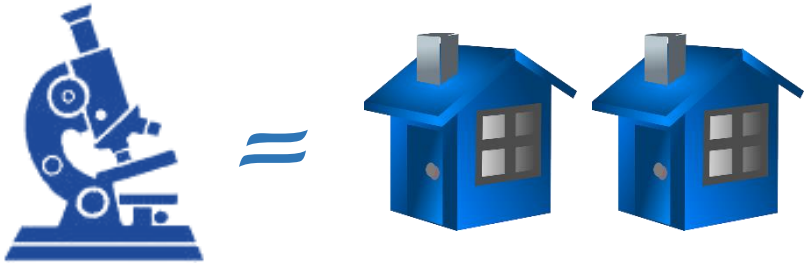
NBIO 890-001 Microscopy Principles and Applications

To update the graduate course on microscopy to be in pace with the modern trend in research. Students need to be able to:

- build scientific equipment on their own
- adapt the equipment built by others through technology transfer
- save money
- overcome the limitations of commercially available equipment and develop independent thinking

Scientific equipment

$10000



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The Challenge

4

weeks

Electronics and 3D Printing

- Joint design of the program and shared materials

- Makerspace provided:
    - Expertise
    - Equipment
    - Materials

  Project:
  A simple compound microscope with adjustable light source

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The Challenge

weeks
is NOT
ENOUGH

Evaluation

Interesting and fun, but could have been more related to the general topic

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The Future

weeks is NOT ENOUGH

Changed approach (Lessons learned)

We will use the Makerspace

- Throughout the full semester
- In the context of the material presented / intertwined approach
- Build a few projects of useful equipment

Projects:

- Mobile phone-based microscope
- A simple compound microscope
- Liquid handling for tissue clearing
- …and more

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Acknowledgements

Makerspace

- Richard Superfine
- Danianne Mizzy
- Michelle Garst
- David Romito

Students

- Kelly Carstens
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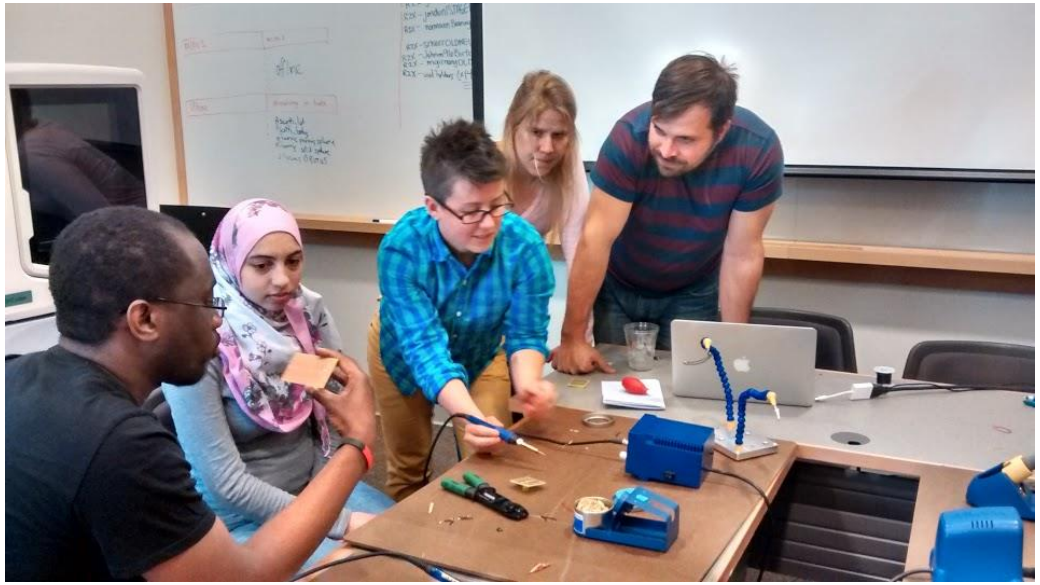
- Esteban Oyarzabal
- James Taylor



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