Preparing All Learners for the Future of Work

1:00 – 2:00pm
June 13, 2019
PRESENTERS

Carrie Parker
Education Development Center
Chair

Ritu Raman
Massachusetts Institute of Technology
Presenter

Emily Reid
AI4ALL
Presenter

Sheryl Sorby
University of Cincinnati
Presenter
A little personal history
Innovation is a force for social change
STEM journey

1991 – 2007  3 continents, 5 languages, 10 schools, no particular STEM focus
2007  How do you apply to college?
2008  Cornell, Aerospace to BME
2009  Bird watching, rat walking, and water cleaning (oh my)
2010  Entrepreneurial fellowship at a biotech startup
2011  Research + preparation for graduate school
Learning how to build with biology

Can I build *beyond* biology?

Can I teach others to build beyond biology?

Should you build beyond biology?

Biohybrid Design:
A new era in bioethics

Ritu Raman
Postdoctoral Fellow, MIT

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Encouraging young people interested in STEM

Focus on goals external to yourself

Find good friends and mentors

Learn to work with others

Live by your conscience and trust your instincts

Don’t be afraid to change and adapt!
Encouraging young people: real world example
Empowering young women: real world example

The WiSDM (Women in STEM Database at MIT) is an initiative designed to promote the visibility of women in our academic community. The goal of WiSDM is to provide a curated searchable online database of MIT women, making it easier to find talented and diverse speakers for conference talks, panels, news stories, and outreach events.

WiSDM includes MIT faculty, postdocs, research staff, and graduate students from all STEM fields. In addition to including each listed speaker’s areas of technical expertise, the database also includes information about non-technical expertise, ranging from science policy to entrepreneurship to outreach. WiSDM’s searchable database makes it easy to find qualified and talented speakers for your event.

Stay up to date by signing up for our newsletter and searching our regularly updated database.

Why use WiSDM? We believe that the best conversations are sparked by diverse voices, and we want to make those voices easy to find. Search WiSDM to find speakers for your next event!

Why be listed in WiSDM? Speaking opportunities are an incredibly effective way to engage with your academic community, and contribute to your professional advancement. Make your voice, your story, and your perspective a part of the conversation by joining WiSDM today.

Don’t see someone who should be listed? Contact us and we will invite them to join the database.
Takeaways for training the next (diverse) generation

Identify the real-world impact of every basic scientific or mathematic concept

   Especially important to find a range of relevant examples that connect with diverse audiences

Provide examples of role models and invite them into the classroom

   Virtual or in person lunch with a scientist (WiSDM, 500 Women in Science, etc.)

Fight the stereotype of the “lone scientist” and incorporate ways to acknowledge the unique contributions of each group member

   Include discussions of ethics, regulatory, and funding frameworks – innovation is a team sport!

Read science news articles and talk about the importance of not overstating the conclusions of a research study

   Split the classroom into a “news article” group and a “research article” group and compare conclusions
Acknowledgements

Mom, Dad, Granddad

Large bubble of incredibly supportive friends in and out of STEM

Fantastic mentors and role models

Great teachers throughout the years: Mr. Harrison, Prof. Bonassar, Prof. Bashir, Prof. Langer

Academic, professional, financial support for women in STEM
Preparing all learners for the future of work:

How I learned to build with biology

Ritu Raman
Postdoctoral Fellow, MIT

RituRaman.com | ritur@mit.edu | @DrRituRaman
Creation over Preparation in CS Education

Emily Reid
Where I’m Coming From
Gerald

WOW, YOU SUCK AT MATH.

\[ \int x^2 = \pi \]

WOW, GIRLS SUCK AT MATH.

\[ \int x^2 = \pi \]
Lesson 1: Hello World

Lesson 7: To create a map at a specific street address using geocoding service

Lesson 11: Add layers and markers to the map

This is how I spent my summer vacation and it's awesome!
Computer Science Education/D&I Work
What Has Worked in my Experience

1. Belief in every student’s capability to learn, create, and influence
2. Connecting to what students already care about
3. Building community
4. Understanding the value of role models & mentors
5. Growth mindset approach (vs. a “weed-out”-style course)
6. Emphasis on “future-proof” skills:
   ○ Computational thinking
   ○ Communication
   ○ Creativity
   ○ Leadership
7. Project-based learning
We Could Be Doing Better


https://www.seattletimes.com/business/microsoft/how-linkeds-search-engine-may-reflect-a-bias/
One Example: Bias in Facial Recognition

Gender Shades, Joy Buolamwini, Timnit Gebru, 2018
Social Impact Opportunity

Water

AI can help model global water supply to better respond to clean water shortages.

Agriculture

AI can help monitor the health of farms, in turn helping farmers to better address looming food shortages.

Climate Change

AI can help accurately model climate change to help communities respond.

Biodiversity

AI can help detect and monitor biodiversity and predict the spread of disease.

The Future Computed: Artificial Intelligence and its role in society, Microsoft, 2018
Economic Opportunity

2.3 Million Jobs
Projected AI Job Growth, compared to 1.8 Million Jobs Replaced by AI by 2020

~$500B
Projected new value for tech industry that will result from improving diversity
Student Examples: Akka Creativity Team
Student Examples: Stephanie

Stephanie is researching AI solutions for predicting the flow of contaminated water and created an AI club at her high school.

For every student that goes through our programs, they educate 14 more.
Sparking interest is not enough.
We need to let students know they can create our future using technology.
They are active participants.
Message to students: Computer science is a tool to solve problems you care about.
Gateway to STEM: Improving 3-D Spatial Skills
What are spatial skills?

Guay, 1976
Longitudinal Study

- Followed 400,000 students over a 30 year period
- A child’s spatial skills level is a better predictor of STEM attainment than is their math skill level

Wai, Lubinski, & Benbow, 2009
Who is at risk of poor spatial skills development?

- Girls/women
- Students from low SES backgrounds

Lippa, Collaer, & Peters (2009)
Spatial Skills can be learned!
Spatial skills improved
Grades in STEM Courses Improved

- Engineering
- Calculus
- Chemistry
- Physics
- Computer Science

Training vs. No Training
More Students Graduated from Engineering

![Bar chart showing the number of students graduating from engineering programs based on spatial skills and gender.]

- **Women**:
  - Good Spatial Skills: [60%]
  - Poor Spatial Skills: [50%]
  - Spatial Skills Training: [70%]

- **Men**:
  - Good Spatial Skills: [65%]
  - Poor Spatial Skills: [55%]
  - Spatial Skills Training: [65%]
Current Projects

• Impact of spatial skills training on performance in:
  – Computer Science
  – Mathematics
  – Others
Fewer students scored “Unsatisfactory” on state math assessment
Computer Science

• Summer Camp for rising senior girls
  – Intervention helped girls from low SES groups learn to code
• First-year CS at the university level
  – Intervention helped students learn to code
  – Improved attitude about CS
Teacher Quote:

Students love the blend of using software to watch visualizations of different types of transformations, modeling with snap cubes, and the change of pace of conversation with their peers about mathematics.

Teaching spatial skills has allowed some of my students, who struggle with traditional numeric operation and algebraic mathematics, to really shine and lead their peers. Several of my "struggling students" have taken leadership roles during these lessons; teaching their classmates, walking their peers through problems, and explaining what they are able to visualize.
Conclusions

• Well-developed spatial skills are a key to success in STEM fields
• Spatial skills training has a positive impact on STEM performance
  – Especially for women and girls
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    • HRD-1159252
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