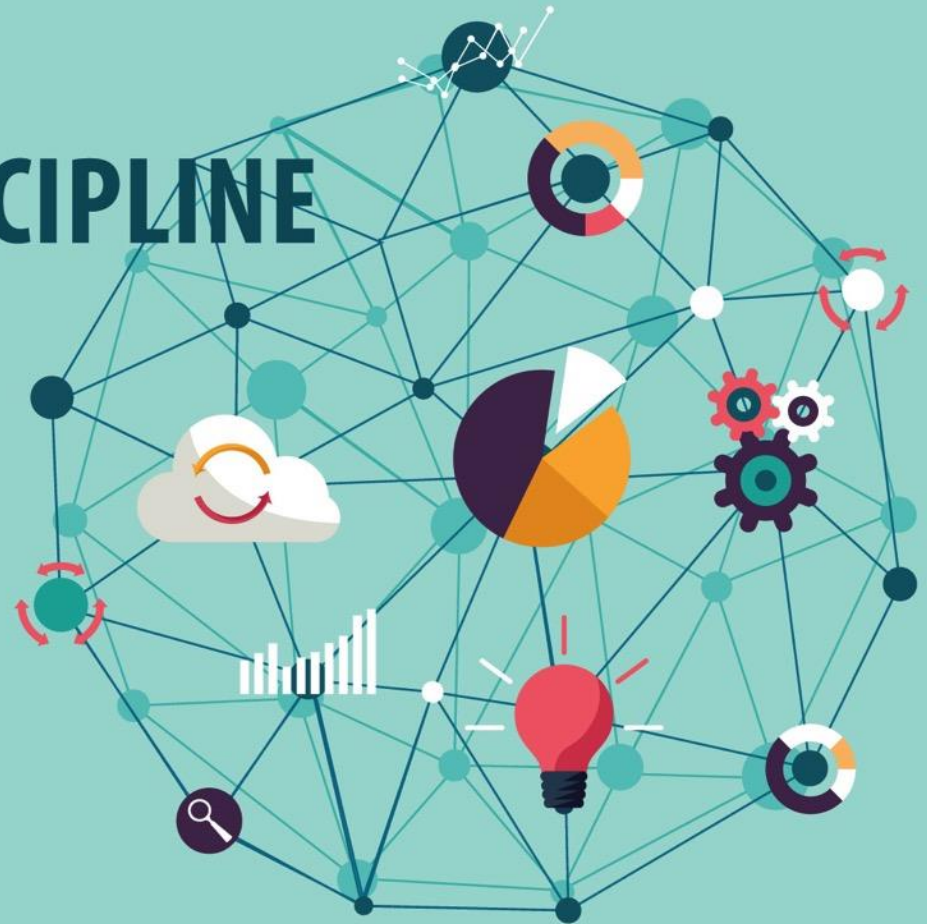


Envisioning the
DATA SCIENCE DISCIPLINE
The Undergraduate Perspective

Webinar Series
Fall 2017



*The National
Academies of*

SCIENCES
ENGINEERING
MEDICINE

nas.edu/EnvisioningDS

Envisioning the **DATA SCIENCE DISCIPLINE**

The Undergraduate Perspective

9/12/17 – Building Data Acumen
(recording posted)

9/19/17 – Incorporating Real-World
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for Data Science Programs

11/7/17 – Diversity, Inclusion, and
Increasing Participation

11/14/17 – Two-Year Colleges and
Institutional Partnerships

**Provide input and learn more
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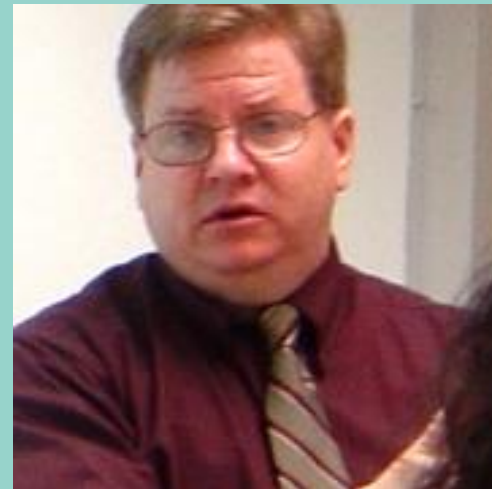
Envisioning the **DATA SCIENCE DISCIPLINE**

The Undergraduate Perspective

Faculty Training and Curriculum Development



Michael Posner, Villanova University
*Associate Professor of Statistics and
Director, Center for Statistics Education*



Bob Panoff, The Shodor Education Foundation
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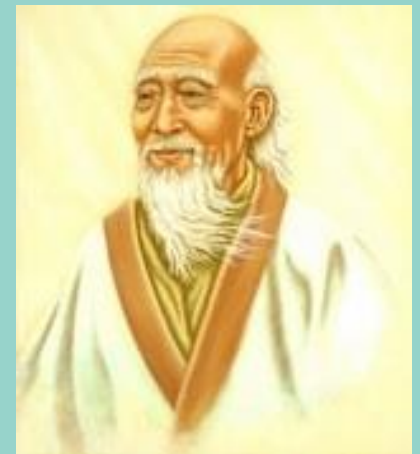


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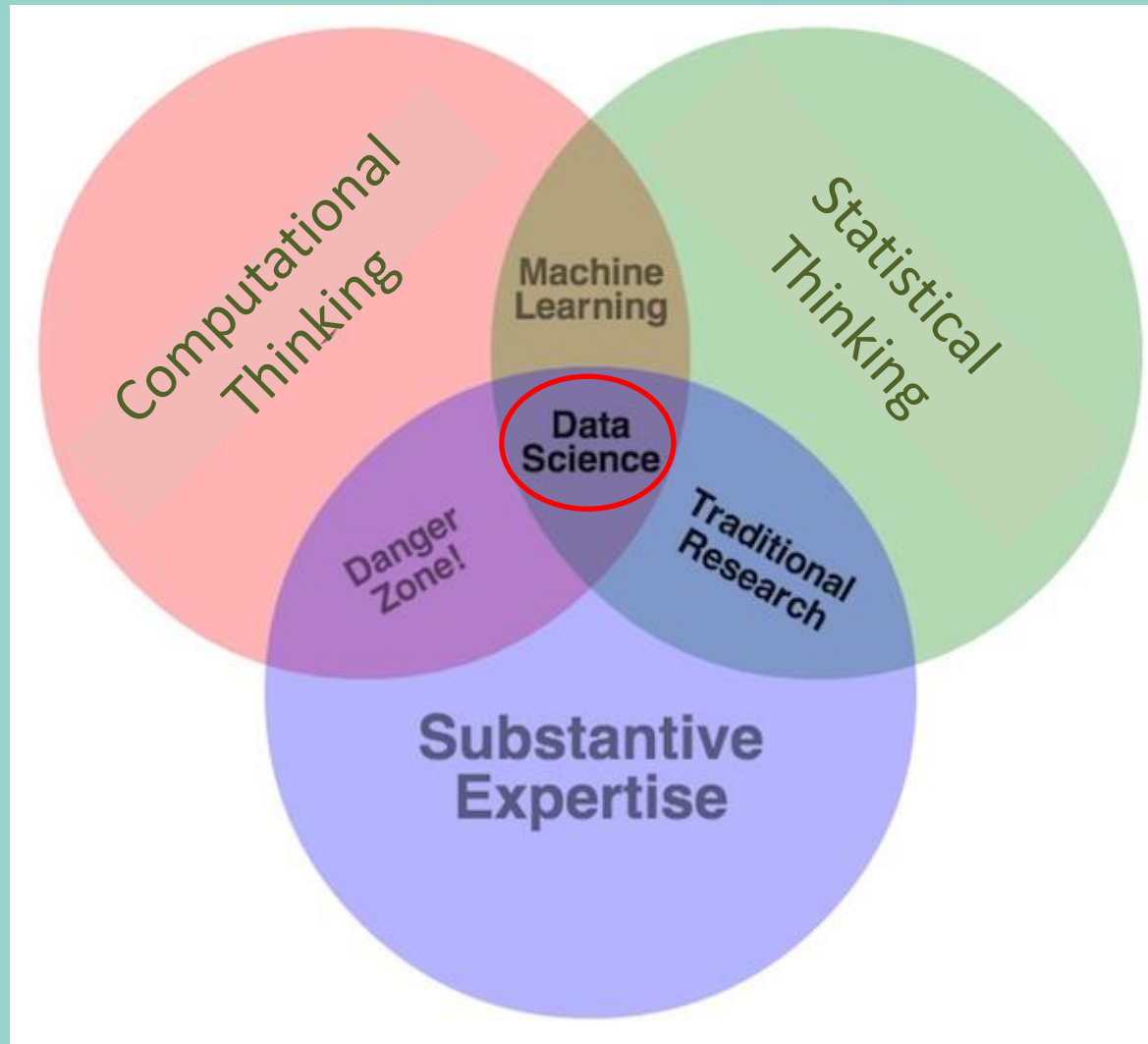
Go To The People: Impactful Faculty Training in Data Science

Go To The People

“Go to the people. Live with them. Learn from them. Love them. Start with what they know. Build with what they have. But with the best leaders, when the work is done, the task accomplished, the people will say 'We have done this ourselves.’” — [Lao Tzu](#)



The Venn Diagram

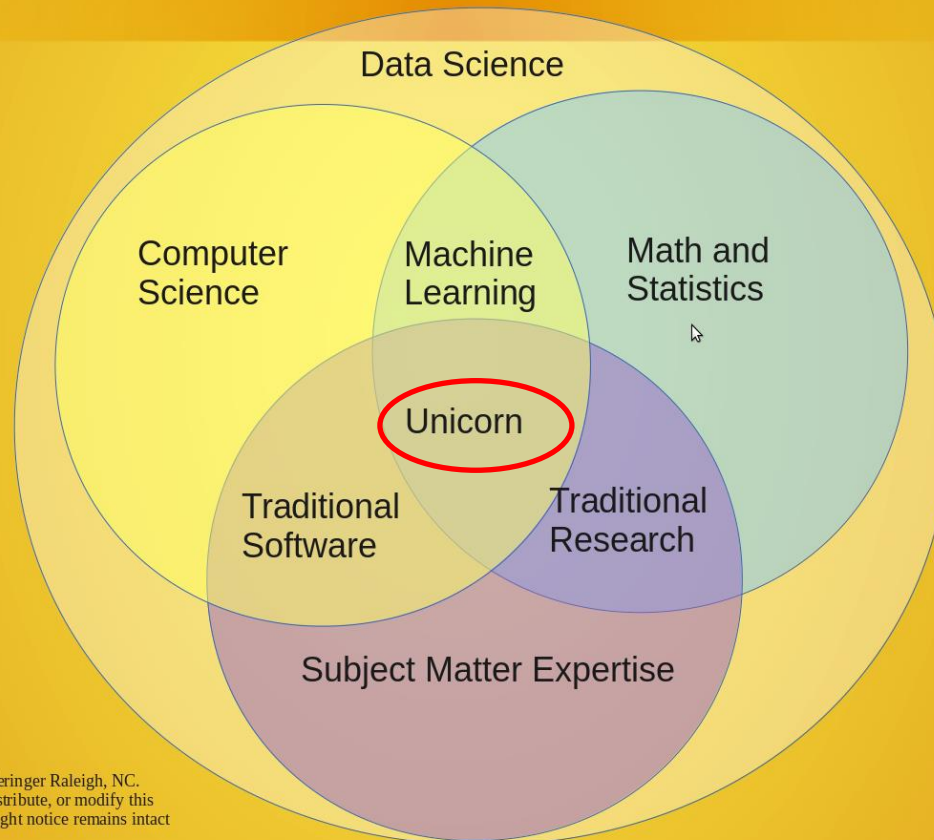


www.niemanlab.org

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Another Venn Diagram

Data Science Venn Diagram v2.0



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www.itworld.com

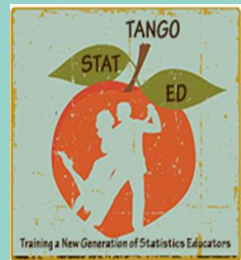
DS Courses & CSE

- Data Science – Villanova University
 - Intro to Data Science – co-taught w/CS fac, Fall 2016
 - Data Science Using R - 2 sections, Fall 2017
 - Data Science For All (NSF DUE#1432438, \$285k, Co-PI)
- Center for Statistics Education (Founding Director)
 - Summer workshops for in-service teachers
 - AP Stat teachers and college professors
 - Significant interest in learning R for data science

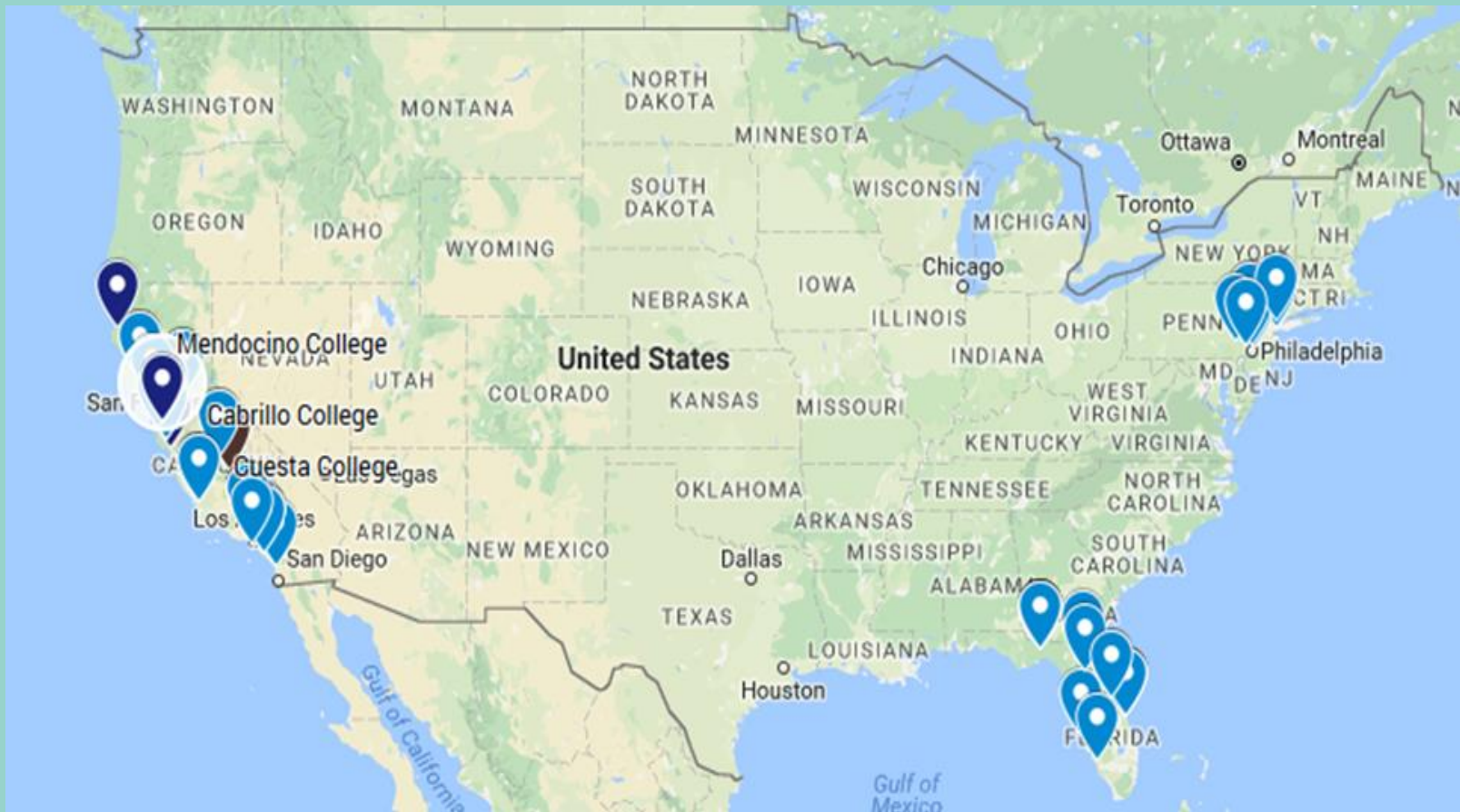


TANGO Stat Ed

- Training a New Generation of Statistics Educators (TANGO Stat Ed)
 - NSF-funded grant (IUSE, DUE#1432251, \$572k, PI)
 - Co-PI Monica Dabos, College of the Canyons
 - 72 Next Generation Instructors (NGIs)
 - Four components
 - Training workshop (and refresher)
 - Pair NGI with mentors in stat ed community
 - Bring NGIs to USCOTS 2015 and USCOTS 2017
 - Create professional learning communities in 4 regional hubs

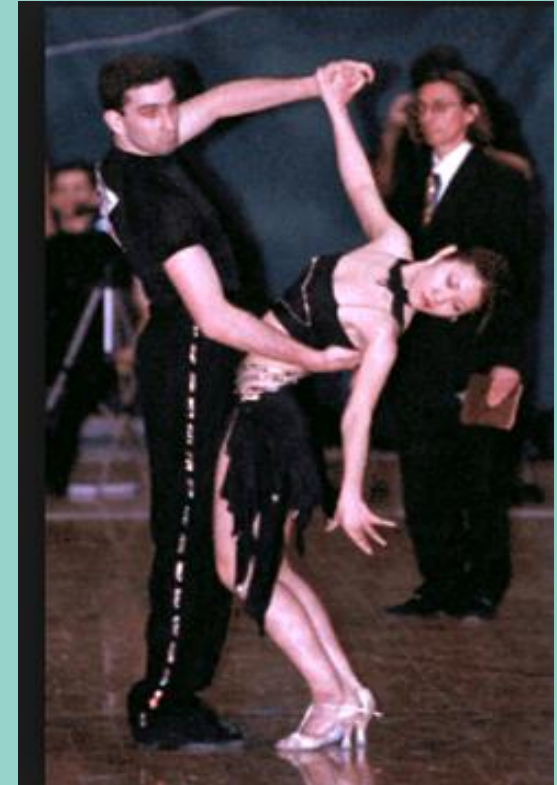


TANGO Stat Ed Map



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Why “TANGO”?



Why Two-Year Colleges?

Data from CBMS 2015

“Test Your Knowledge about the Two Year College”
Poster at US Conference on Teaching Statistics 2017

	Actual Value	Guess of 4YC Faculty
% of stat students taught at 2YC	66%	49%
% growth in stat enrollment at 2YC since 2010 (note: 23% at 4YC)	102%	54%
% of 2YC stat instructors w/stat degree	5%	10%



Evaluation of TANGO Stat Ed

- Some incomplete/early evaluation data
 - 86% improved attitude towards statistics
 - 100% improved attitudes towards statistics education
 - 79% improved statistics content knowledge
 - 100% improved statistics pedagogy
 - 0% said teach same way after TANGO Stat Ed
- Successes
 - Participants created sustainable infrastructure
 - Website (us), regional organizer, Zoom room, OER commons group

TANGO Stat Ed From NGIs (Next Generation of Instructors).



Lisa Grossbauer
Presents resources and tools
from TANGO to her colleagues

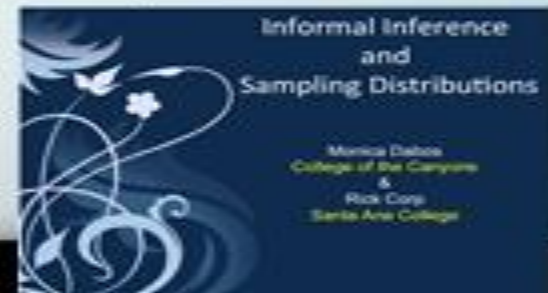
Dustin Silva and
Monica Dabos
present at CMC3



Dustin Silva and
Ambika Silva
present at CSI

Joe Gerda and
Roxy Peck
present at CSI

Richard Corp and
Monica Dabos
present at CSI



Impactful Faculty Training Programs

- Why did TANGO Stat Ed succeed?
 - Recognized role of 2YCs in statistics education
 - The “bug”, lower level data scientists important, sheer #s
 - Created communities of learning
 - NGIs became advocates and seeds within their communities
 - Pedagogical choices of young faculty supported
 - Organizational approval was crucial (GAISE, authors)
 - Supported innovation and leadership of NGIs
 - “Leaders don’t create followers, they create more leaders”
 - Mentorship pairing
 - It was all paid for! Thank you, NSF!

Impactful Faculty Training Programs

- Additional Recommendations
 - Reach out to your community – be the leader!
 - Disciplinary partners at your institution
 - Data and methods for use in class/collaboration
 - Marketing to students
 - 2YCs
 - High Schools
 - Ex: mobilizecs.org – Introduction to Data Science
 - Identify local needs (connect with industry)
 - Incentives
 - Mix of intrinsic and extrinsic motivators
 - Cross-disciplinary collaborations on curricular reform

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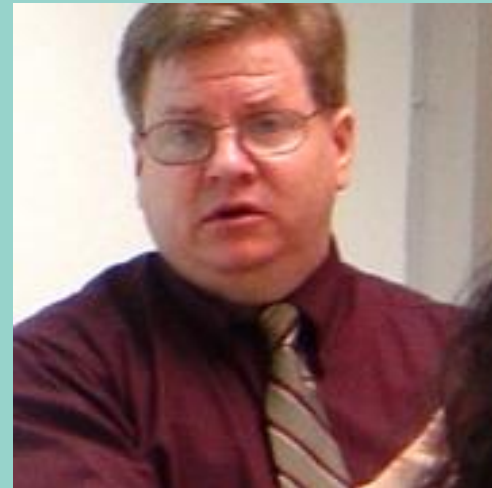
Go To The People:
Impactful Faculty
Training in Data
Science
Q & A

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Faculty Training and Curriculum Development

Shodor, NCSI,
XSEDE and Blue
Waters: How can
we help?



Bob Panoff, The Shodor Education Foundation
Founder and Executive Director

Topics

- XSEDE, Blue Waters, NCSI, Shodor
- Training V. Education:
- Transforming/Scaling Faculty Interactions
- Transforming Curricula and Degrees
- Helping undergraduates do the work of HPC

National Computational Science Institute and Shodor

Excitement → Experience → Expertise

- Develop Computational/Data Thinkers Early
- Middle and High School EXCITEMENT
- High School and College EXPERIENCE
- College and Grad School EXPERTISE
- A Motivated, Capable, Diverse Workforce

Training v. Education

Distinctions v. Differences

- Rudimentary skills in “CDSE”
- Expectation, Observation, Reflection
- Re-presentation Supporting Representation
- How to do X vs. Why would you want to do X?
- How do you know if it is right?
- Needs for Both:
 - Simple examples, well done
 - Complete codes

XSEDE and Blue Waters support

High-Performance Computing (HPC) needs high performing workforce:

Work with *faculty* to develop *students* who understand modeling and simulation principles, applications of models, data analysis at large scale, and how to make it all work

- Requirements for high fidelity models of complex systems
- Managing and understand large datasets – data science
 - Analysis, workflow, visualization
- Applications across a wide range of science, social science, and increasingly humanities

Pathways to Reform and Improvement

Integrate computational and data examples into basic science and math courses

Create "Gen Ed" courses that introduce simulation, modeling, and data concepts and applications

Combine those efforts to create formal concentrations, minors, or certificates in computational and data science

XSEDE is working with institutions to assist with those activities

Transforming/Scaling Faculty Interactions and Support

- Extensive history of successful:
 - WorkSHOPS: identify ready-to-adapt materials for CDSE
 - WORKshops: build real curricula
- How to scale “hands on”?
- Leverages:
 - Modules that lead to HPC
 - See:
<http://www.hpcuniversity.org>
 - Training for HPC science work skills beyond coding



Transforming Curricula and Degrees

- Extensive history of successful:
 - Campus by Campus Visits
 - Consultation
- Non-XSEDE regional workshop, XS follow-up
- On-going efforts
 - Updated Competencies
 - <http://hpcuniversity.org/educators/competencies/>
 - Module Alignment
 - Training Material Alignment

Students Doing the Work of HPC

EMPOWER - Expert Mentoring Producing Opportunities for Work, Education, and Research

- Expand Beyond ‘Summer Research Model’
- Learners, Apprentices, Interns
- Matched with Mentors and Tasks
 - Research
 - Operations
 - Data Visualization and Management
 - Education, course and material development

Relevant Links

- Shodor: <http://www.shodor.org>
- HPC University: <http://www.hpcuniversity.org>
- NCSI: <http://computationalscience.org>
- XSEDE: <http://www.xsede.org>
- Curriculum Modules:
<http://shodor.org/petascale>

Contacts

- Bob Panoff: rpanoff@shodor.org
- Kate Cahill: kcahill@osu.edu
- Jennifer Houchins: jhouchins@shodor.org
- Linda Akli: akli@sura.org



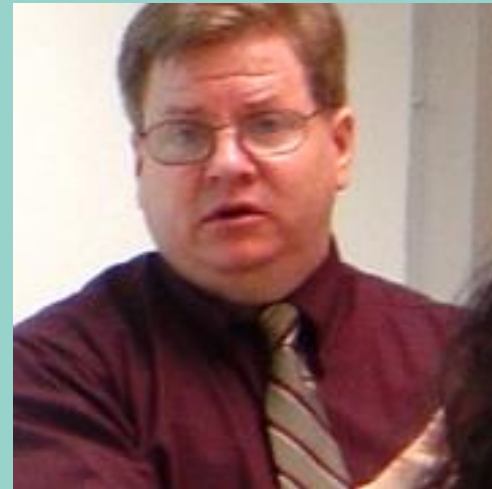
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