EER&I Networking Session
Connecting and Expanding the Engineering Education Research & Innovation (EER&I) Communities

ASEE Annual Conference – June 28, 2016 – T459A – 1:15 pm – 2:45 pm

Facilitated By

Karl A. Smith
Purdue University and University of Minnesota

Ruth A. Streveler
Purdue University

Rocio Chavela Guerra
American Society for Engineering Education
## Agenda

<table>
<thead>
<tr>
<th>Session</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Introduction of session and facilitators</td>
<td>10 min</td>
</tr>
<tr>
<td>Brief reports on status of EER&amp;I</td>
<td>35 min</td>
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<tr>
<td>• Update on EER initiatives – Ruth Streveler</td>
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<td>• Update on EEI initiatives – Rocio Chavela-Guerra</td>
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<td>• Other Updates</td>
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<td>• Update on new Departments with EER PhD programs</td>
<td></td>
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<tr>
<td>• Update by David Radcliffe, Head, School of Engineering Education, Purdue University</td>
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<tr>
<td>Participant Networking</td>
<td>35 min</td>
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<tr>
<td>• Rapid introductions around guided questions – Four to five conversations in groups of 3 – as a way to meet many people</td>
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<tr>
<td>• Identification of “intellectual neighborhoods” around research and innovation questions and opportunities – individual reflection and writing</td>
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<tr>
<td>Brainstorming on strategies to connect, expand, and sustain the emerging EER and EEI communities</td>
<td>10 min</td>
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<tr>
<td>• Summary of ideas for (a) local, (b) national – conferences, etc. and (c) virtual community</td>
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<tr>
<td>• Individuals share reflections with the large group, facilitators sum up the session and participants complete feedback forms</td>
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<td>• Other Updates</td>
<td></td>
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<tr>
<td>• National Academy of Engineering – Beth Cady</td>
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<tr>
<td>• Association of Public and Land-Grant Universities – Network of STEM Education Centers – Kacy Redd</td>
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<td>• Engineering Education Community Resource – Ken Yasuhara &amp; Adam Carberry</td>
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<tr>
<td>• EER Research Resources – Amy VanEpps</td>
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<tr>
<td>• Update on new Departments with EER PhD programs</td>
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<tr>
<td>• Arizona State University – Ann McKenna</td>
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<td>• University of Michigan – Cindy Finelli</td>
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<td>• Ohio State University – Monica Cox</td>
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<tr>
<td>• Update by David Radcliffe, Head, School of Engineering Education, Purdue University</td>
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</table>
Update

- **Ongoing research about the long-term impact of RREE**
  - ASEE paper *Voicing the indescribable: Using photoelicitation as a method to uncover belonging and community (Session M514C)*

- **Resources**
  - CLEERhub has moved
  - [https://stemmedhub.org/groups/cleerhub](https://stemmedhub.org/groups/cleerhub)
  - Googling CLEERhub will take you to this site!

- **New space for to build methods and theories in EER**
  - [https://ruthstreveler.wordpress.com/engineering-education-research/](https://ruthstreveler.wordpress.com/engineering-education-research/) [link from Purdue ENE website]
Research to Practice

- Neuroscience research in EER incorporated into teaching
  - Content, Assessment, Pedagogy
    - At Purdue
    - Other institutions - Skoltech
  - Neuroscience in Engineering Education Research
    - New course at Purdue Spring 2017
  - Industry workshops
    - How People Learn Engineering (Boeing)
VentureWell is a non profit higher education network that cultivates revolutionary ideas and promising inventions.
I-Corps™ for Learning

Evidence-based Entrepreneurship™ to Improve STEM Education

www.asee.org/i-corps-l
## I-Corps™ L History

<table>
<thead>
<tr>
<th>June 2013</th>
<th>June 2014</th>
<th>June 2015</th>
<th>June 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2013: Called to Serve</td>
<td></td>
<td></td>
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<tr>
<td>Jan-Feb 2014: Cohort 1 (Pilot)</td>
<td></td>
<td></td>
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<tr>
<td>Mar-Nov 2014: Redesign</td>
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<tr>
<td>Jan-Feb 2014: Cohort 2</td>
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<tr>
<td>Mar-May 2015: Redesign</td>
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<tr>
<td>Jul-Aug 2015: Cohort 3</td>
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<tr>
<td>Apr-Jun 2016: Redesign</td>
<td></td>
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<tr>
<td>Jul-Aug 2016: Cohort 4</td>
<td></td>
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</tbody>
</table>
The Growing Network of I-Corps™ L

- 3 Cohorts
- 54 Teams
- 175 Participants
- 15 Instructors
- 3 Evaluation Partners
Key Features of I-Corps™ L

- **I-Corps™ Model**
  - Curriculum (BMC, Customer Discovery & Agile Engineering)
  - Teams recruitment

- **Balanced Teaching Team**
  - I-Corps™ L Faculty
  - I-Corps™ Node Faculty
  - Entrepreneurs

- **Emphasis on Learning**
- **Syllabus Iterations**
- **Teams Composition**
- **Course-specific Outcomes**
- **Assessment Instruments**

### Table: Evidence of Criteria in Team’s BMC

<table>
<thead>
<tr>
<th>Team Name</th>
<th>Team #</th>
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</thead>
<tbody>
<tr>
<td>TTREC</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEAM DECISION</th>
<th>Go</th>
<th>No Go, But Continue</th>
<th>No Go</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTREC</td>
<td>Go</td>
<td>No Go, But Continue</td>
<td>No Go</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teaching Team criteria for a ‘Go’ decision:</th>
<th>None (1)</th>
<th>Poor (2)</th>
<th>Adequate (3)</th>
<th>Outstanding (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Value propositions align with customer segments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Evidence of champion (decision-maker) from at least one customer segment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Specific and concrete definition of scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Credible path towards scaling and sustaining identified</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Value of the Investment

- Helps develop an entrepreneurial/intrapreneurial mindset of STEM educators/innovators

- Produces skills and awareness to align Customer Segments and Value Propositions

- Produces valued outcomes to participants’ careers, research and teaching
Entrepreneurial/Intrapreneurial Mindset

Course increased my interest in starting a company*

<table>
<thead>
<tr>
<th></th>
<th>I-Corps™ Nat'l Cohorts</th>
<th>I-Corps™ L Jul/Aug 2015</th>
<th>I-Corps™ L Jan-Feb 2015</th>
<th>I-Corps™ L Pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree and Strongly Agree</td>
<td>85%</td>
<td>88%</td>
<td>71%</td>
<td>17%</td>
</tr>
</tbody>
</table>

*Agree and Strongly Agree

“My knowledge of business and entrepreneurship was extremely limited. Now, I am even thinking that I might consider a startup business.”

— Principal Investigator
### Outcomes: Teaching, Research, Career...

<table>
<thead>
<tr>
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<th>I-Corps™ L Pilot</th>
<th>I-Corps™ L Jan-Feb 2015</th>
<th>I-Corps™ L Jul-Aug 2015</th>
<th>I-Corps™ Nat'l Cohorts</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will use I-Corps™ concepts in my teaching. (PIs)</td>
<td>76%</td>
<td>72%</td>
<td>82%</td>
<td>85%</td>
</tr>
<tr>
<td>I will use I-Corps™ concepts in my research. (PIs)</td>
<td>76%</td>
<td>77%</td>
<td>72%</td>
<td>83%</td>
</tr>
<tr>
<td>I will use I-Corps™ concepts in my career. (all)</td>
<td>85%</td>
<td>88%</td>
<td>90%</td>
<td>95%</td>
</tr>
<tr>
<td>I will use information from the I-Corps™ L course in designing future learning innovations. (Els/PIs)</td>
<td>100%</td>
<td>95%</td>
<td>92%</td>
<td>not asked</td>
</tr>
<tr>
<td>I will seek other funding for my innovation within the next 12 months. (PIs/ELs)</td>
<td>17%</td>
<td>49%</td>
<td>58%</td>
<td>80%</td>
</tr>
</tbody>
</table>
Next Steps

- Upcoming Cohort: July-August 2016

- Sustaining and Scaling STEM Education Innovations for Broader Impact
  - Increasing Awareness
  - Introduction to I-Corps™ L

- Beyond I-Corps™ L
FACULTY DEVELOPMENT USING VIRTUAL COMMUNITIES OF PRACTICE

CYCLE I:
- Electric Circuits
- Mass and Energy Balance
- Mechanics
- Thermodynamics

CYCLE II:
- Electrical Engineering
- Computer Science and Engineering
- Mechanical Engineering
- Civil Engineering
- Chemical Engineering

OVER 175 PARTICIPANTS FROM +125 INSTITUTIONS

vcp.asee.org
VCP Model for Faculty Development

- Two-tier structure
  - Leadership VCP
  - Faculty VCPs

- Two preparation cycles
  - Knowledge building phase
  - Practical phase

Legend:
- Faculty Communities (FVCPs)
- Leadership Community (LVCP)
Leadership VCP
Action VCP
Safe Zone Workshops
Campus Surveys
- Deans
- Faculty
- Students

diversity.asee.org/lgbtq
NAE EER&I Activities

- Frontiers of Engineering Education (https://www.naefoee.org/)
  - University engineering faculty members exchange ideas around the state of engineering education, analyze innovative practices, develop professional networks, and become change agents to make 21\textsuperscript{st} century engineering education exciting, creative, rigorous, and engaging.

- LinkEngineering (http://linkengineering.org/)
  - Community of practice for educators, researchers, PD providers, pre-service educators, and administrators implementing engineering in preK-12 education

- The Engagement of Engineering Societies in Undergraduate Engineering Education (http://www.nae.edu/Projects/126089.aspx)

- Overcoming Challenges to Infusing Ethics into the Development of Engineers (http://www.nae.edu/Projects/CEES/57196/OvercomingChallenges.aspx)

- More information about these and other projects can be found at www.nae.edu.
For more information contact the NSEC co-directors, Kacy Redd (kredd@aplu.org) and Noah Finkelstein (finkelsn@colorado.edu)
Network of STEM Education Centers (NSEC): 
The network for supporting the transformation of undergraduate STEM education

- National network of centers that focuses on undergraduate STEM education transformation within colleges and universities.
- Addresses calls from the White House (Olson & Riordan, 2012) and National Academies (Singer et al., 2012) for such multi-institutional / nation-wide approaches.
- Network currently links 149 STEM Education Centers (SEC) at 126 institutions (from 246 SECs at 182 institutions identified to date)
- Four year project (NSF #1524832). Original seed funding from the Alfred P. Sloan Foundation with support from APLU.
**STEM Education Center types in the network**

- Hubs of campus efforts leading transformation of undergraduate STEM education, including STEM learning experience for students, broadening participation, understanding teaching and learning, broadening the impact of campus research, and supporting national and regional scale improvement in STEM education
- Large variety in the structure and identity of STEM Education Centers
- Overlapping goals of improving undergraduate and grad ed, teacher prep, outreach, broader impacts
- Often housed within CoS, CoE, or under Provost

Based on 100 center profiles at NSEC. Percentage of centers that have a focus in these areas.

<table>
<thead>
<tr>
<th></th>
<th>K12/teacher pd</th>
<th>Outreach</th>
<th>Undergrad ed</th>
<th>Grad ed</th>
<th>Broader impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>78%</td>
<td>70%</td>
<td>47%</td>
<td>20%</td>
<td>19%</td>
</tr>
</tbody>
</table>
Building the Network

• **Robust and sustained NSEC** that serves the needs of centers for community, professional development, learning about what works, research, and serving as a resource to solve national challenges in STEM education;
  – national conference and two workshops/yr
  – online platform of STEM Education Centers with 105 center profiles
  – *seed grants* for cross-institutional work;

• **Toolkit for centers** (i.e. organization charts, reporting structures, budgets, communication materials, model programs);

• **Guidance documents** on national STEM education issues
Centers in NSEC

Network of STEM Education Centers
APLU/ Sloan / NSF Funded
149 Centers and more coming:
http://serc.carleton.edu/StemEdCenters/
131 centers & groups
48 graduate programs
75 conferences & workshops
60 journals
...and more

engineering education community resource
RESOURCES TO SUPPORT ENGR EDUC RESEARCH

Amy S. Van Epps
Associate Professor of Library Science
Engineering Librarian
PhD Candidate, ENE
Engineering Education LibGuide

http://guides.lib.purdue.edu/engreducation

- Primary databases
- Applicable journals and conferences
- Citation Management information
Engineering Education: Databases

Engineering Education Databases

- Scopus
- ERIC
- Compendex
- Education Full Text
- Technology Research Database (now ProQuest Technology Collection)
- LearnTechLib (more...)
- Professional Development Collection
- Education Source

ENF - Additional Databases

- PsycINFO
- Sociological Abstracts
- Dissertations and Theses
- Web of Knowledge

Subject Guide

Amy Van Epps
Email Me
“Beyond JEE”

http://guides.lib.purdue.edu/beyondjee

• ASEE 2013 poster and paper
• Annually updated, currently 2014 data

• 2015 numbers – original list plus Purdue ENE publication locations; expanded ranking measures
Beyond JEE: Finding publication venues to get your message to the ‘right’ audience: Engr Educ Results

A quick guide that presents the information included in a 2013 ASEE Annual Conference paper and poster presentation. Updated in August 2014 to include 2013 ranking information.

### Sub-category of engineering education titles

<table>
<thead>
<tr>
<th>Title</th>
<th>h-index (PoP)</th>
<th>Total of rankings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal of Engineering Education * ^ %</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>IEEE Transactions on Education %</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>Engineering Education: Journal of the Higher Education Academy Engineering</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>European Journal of Engineering Education (EJEE) #</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Journal of Professional Issues in Engineering Education and Practice</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>The Online Journal for Global Engineering Education (OJGEE) #</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Journal of Pre-College Engineering Education Research (J-PEER) #</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>International Journal of Engineering, Social Justice and Peace #</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>International Journal of Engineering Pedagogy (IJPED) #</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>American Journal of Engineering Education (AJEE) - # potential predatory publisher</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>International Journal of Continuing Engineering Education and Life-Long Learning (IJC2ELL) #</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Journal of Applications and Practices in Engineering Education #</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>International Journal of Collaborative Engineering (IJCE) #</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Engineering Education Letters #</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>International Journal of Engineering Education (IJEE)</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Advances in Engineering Education (AEE)</td>
<td>11</td>
<td>0</td>
</tr>
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</table>

Subject Guide

Amy Van Epps

Email Me
Ph.D. in Engineering Education Systems and Design (EESD)
Arizona State University

We are risk takers, entrepreneurs, makers, and scholars: **join our ecosystem of innovation.**

engineering.asu.edu/eesd
Why EESD at ASU?

- Develop the next generation of engineers
- Join an active community of engineering education scholars
- Get a close look at an undergraduate engineering program with an innovative design project course sequence and close ties to industry, global and community partners
- Become a part of a university that is reinventing the culture around higher education (ASU was ranked the #1 most innovative school in the recent U.S. News and World report)
- Earn your doctorate on ASU’s Polytechnic Campus, which combines the benefits of a smaller campus community with opportunities and activities available in a major metropolitan city
Active Research Areas

Faculty areas of expertise include:

- Engineering student pathways
- Increasing participation and retention of underrepresented groups in engineering
- Engineering identity development
- Making and the maker movement
- Effective teaching and assessment strategies for engineering education, including the use of learner analytics to increase understanding of online students
- Entrepreneurship

Some of the target populations that we support within these research areas are:

- K-12 students
- Students in higher education
- Graduate students
- Early career professionals
- Faculty
- Underrepresented groups
Engineering Education Research Initiatives at University of Michigan

EER&I Networking Session
2016 ASEE Conference
June 28, 2016
EER Faculty

- Tenured/tenure-track *EER faculty* integrated into traditional engineering departments at University of Michigan

**Shanna Daly**  
Assistant Professor  
Mechanical Engineering

**Cindy Finelli**  
Associate Professor  
Electrical Engineering & Computer Science; Education

**Aileen Huang-Saad**  
Assistant Professor  
Biomedical Engineering

**Joi Mondisa**  
Assistant Professor  
Industrial & Operations Engineering
EER Students

- Strong *community* of undergraduate, graduate, and postdoctoral researchers
- **EER certificate** for engineering PhD students (est. 2009)
  - Teaching Engineering (3 credits)
  - Quantitative methods for educational research (at least 3 credits)
  - Qualitative methods for educational research (at least 3 credits)
  - EER project (3 credits or equivalent)
- College-wide **EER PhD program**
  - Under development, to be available 2018
EER Leadership

- ASEE’s 2016 Benjamin Garver Lamme Award bestowed

David C. Munson, Jr.
Robert J Vlasic Dean, Engineering
Professor, Electrical Engineering & Computer Science
EER Leadership

- 37 EER presentations made at ASEE by 51 UM authors

Robert Coffey Jr.  
Aline Cotel  
Grace Cravens  
Tizoc Cruz-Gonzalez  
Shanna Daly  
Michael Deininger  
Matthew DeMonbrun  
Andrew DeOrio  
Elizabeth Dreyer  
Cynthia Finelli  
Robin Fowler  
Alexander Ganago  
Andrew Giugliano  
Deborah Goldberg  
Armanda Gonzalez  
John Gosbee  
Laura Hirshfield

Amy Hortop  
Aileen Huang-Saad  
Linh Huynh  
Megan Kaczanowski  
Vasudha Kilaru\(^F\)  
Hyunsoo Julian Kim  
Joshua Kotrba  
Stephanie Kusano  
Lisa Lattuca  
Jennifer Lee  
Di Ma\(^D\)  
Raghava Mahankali\(^F\)  
Quamrul Mazumder\(^F\)  
Joanna Millunchick  
Ibrahim Mohedas  
Joi-Lynn Mondisa  
Christina Morton

Erika Mosyjowski  
Mohammad Rasouli  
Amy Rechkemmer  
Sahithya Reddivari  
Sara Rimer  
Rachel Schmedlen  
Colleen Seifert  
Kathleen Sienko  
Steven Skerlos  
Sarah Sobek  
Jan Stegemann  
Alexandria Steiner  
Tasha Tardieu  
Michael Umbriac  
Julianne Vernon  
Jennifer Wenger  
John Wolfe

\(^D\) U-M Dearborn, \(^F\) U-M Flint
Questions

- [http://eer.engin.umich.edu](http://eer.engin.umich.edu)

- Email: eerprogram@umich.edu
Undergraduate Education

- **First-Year Engineering Program (2300 students)**
  - Robot Lab
  - Advanced Energy Vehicle
  - Student Instructional Leadership Team (SILT)

- **Multidisciplinary Capstone**
  - Business, industrial design, humanities, and MBA
  - End-of-year design showcase

- **Integral Business and Engineering 4-year program**

- **Engineering Sciences Minor**

- **Engineering Technical Communication**
  - Technical workshops
  - Creative Writing & Arts Contest

Contact: Dr. Lisa Abrams, Associate Chair
E-mail: abrams.34@osu.edu
Graduate Education

Graduates of the Ph.D. in Engineering Education at The Ohio State University will be able to

• identify, discuss, and address critical issues facing engineering education in alignment with stakeholder needs;
• design, conduct, and critique research in engineering education;
• demonstrate, value, and apply engineering expertise;
• create, teach, and assess courses and curricula; and
• identify, demonstrate, and value appropriate personal and professional skills, mindsets, and traits;

with attention to inclusion of multiple perspectives and demographics, so that research outcomes are more universally relevant, so that every student has the opportunity to learn, and to create synergy in the midst of differences.

Contact: Dr. Ann Christy, Graduate Chair, Professor
E-mail: christy.14@osu.edu
Faculty

• Ongoing recruitment of tenure track and clinical faculty
• Internal professional development seminars
• Broad range of staff/faculty skills

What do you most look forward to as a new Assistant Professor of Engineering Education at OSU?

Dr. Monica F. Cox, Department Chair, Professor  
E-mail: cox.1192@osu.edu

Dr. Rachel Kajfez

Dr. David Delaine
Careers in Engineering Education

Mentors for junior faculty

Career Supporters (P&T and more...)

Academic Administration

Beyond the Academy
- Industry (various)
- Informal Education
- Professional Societies
- Policy Development
- Social Entrepreneurship

Global Opportunities

David F. Radcliffe
Purdue University
Participant Networking Activity (~35 min)

- **Introductions with Guided Format**
- **Three (~8 min) Conversations in Groups of 2-3**
  - Your Name & Organization
  - Status of EER&I Center or PhD Program/Interest in EER & EEI
  - Suggestions for Starting/Questions About Starting
  - Exchange Business Cards/Contact Information
  - Identify "intellectual neighborhoods" around common research, organization or other questions and interests
  - Talk about ways to follow up
- **Bell will ring once after 7 min and twice after 8 min**
- **Move to a New Group**
Connecting, Expanding & Sustaining the Emerging EER Community (~10 min)

• Small Group (2-3) Brainstorming
  – Ideas for (1) local, (2) national, (3) international Community
  – Ideas for Virtual Community
  – Further Ideas

• Summarize Ideas and Record
• Silently reflect on your interests and plans for engineering education research

• Jot down
  – What do you plan to do next?
  – What are your longer range plans?

• **Continue the conversation during the ASEE conference and beyond**
  – EER&I Networks – CLEERhub, REEN, SEFI, National Innovation Network (NIN), NSEC
  – Meet again at the FIE Conference, October, 2016
Acknowledgement

- We acknowledge the National Science Foundation for funding Karl Smith’s participation (NSF DUE-1355431 and DUE-1451245), and Rocio Chavela’s participation (NSF DUE-1355391, and DUE-1450644)
- And the ASEE for hosting
Thank you!

An e-copy of this presentation will be posted to:

http://personal.cege.umn.edu/~smith/links.html

Facilitated By

Karl A. Smith  
Purdue University and  
University of Minnesota

Ruth A. Streveler  
Purdue University

Rocio Chavela Guerra  
American Society for  
Engineering Education