EER&I Networking Session

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

ASEE Annual Conference – June 27, 2017 – T460A – 1:30 pm – 3:00 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

Introduction of session and facilitators **~10 min**

Updates on status of EER&I **~35 min**

- Brief Reports
  - EER&I Journal Updates – Lisa Benson
  - EER Departments and Resources – Cindy Finelli, Araceli Ortiz / Ken Yasuhara & Adam Carberry
  - NAE Updates – Beth Cady
  - EER Impact Study - Audeen Fentiman & Teresa Walker
- EER initiatives – Ruth Streveler
- EEI initiatives – Rocio Chavela Guerra & Karl Smith
- NSF I-Corps L Evaluation – Gary Lichenstein

Participant Networking **~35 min**

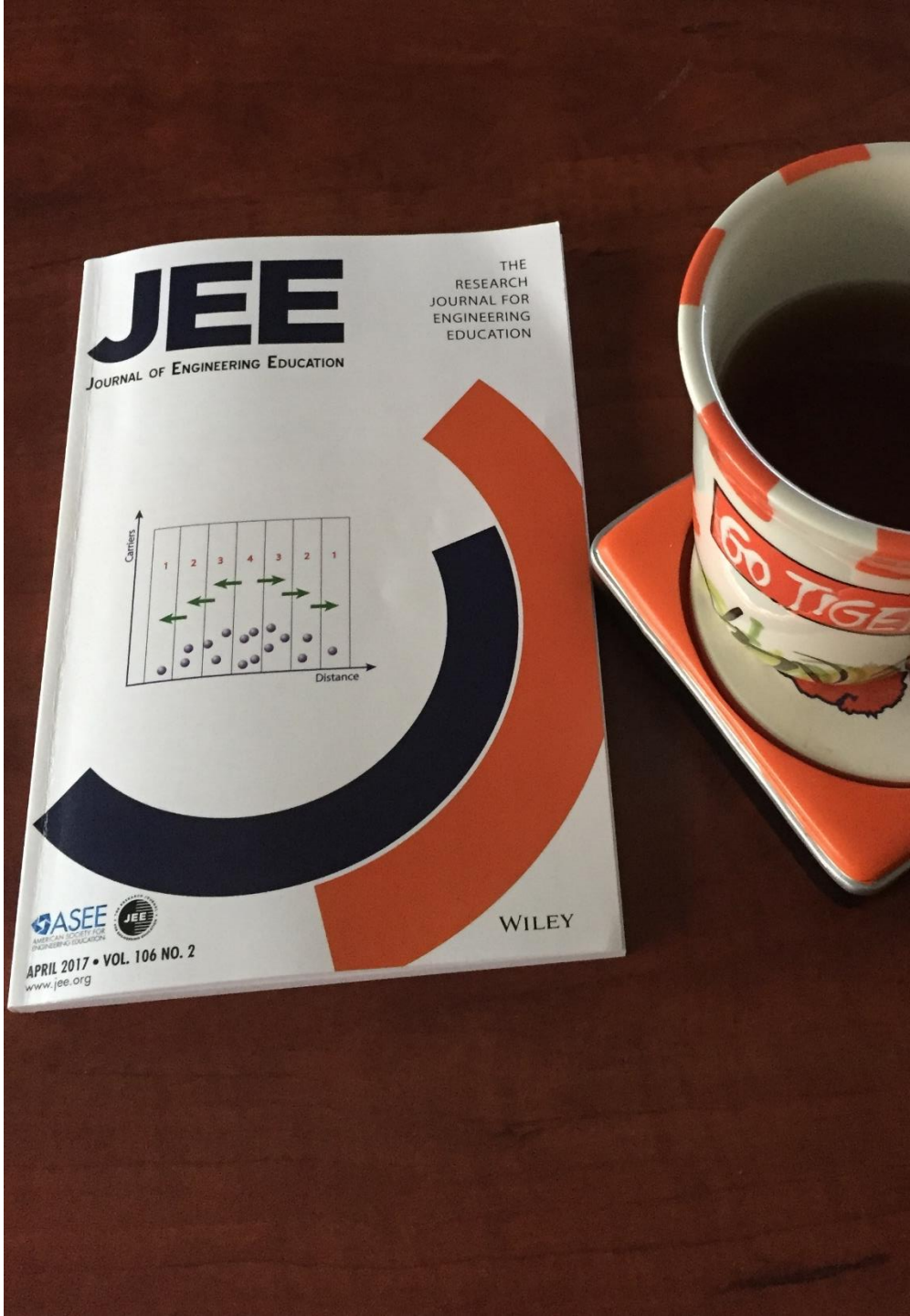
- Rapid introductions around guided questions – Brief conversations in groups of 3 – as a way to meet many people
- Identification of “intellectual neighborhoods” around research and innovation questions and opportunities – individual reflection and writing

Reflection on strategies to connect, expand, and sustain the emerging EER and EEI communities **~10 min**

Journal of Engineering Education

Michael C. Loui
Editor

Lisa C. Benson
Editor as of
July 1, 2017



JEE publishes original research on engineering education

- Articles should significantly advance knowledge about engineering education, with implications for practice or research
- Two kinds of articles:
  - Empirical investigations
  - Research reviews
- Quantitative, qualitative, and mixed methods studies are welcome

JEE will be based at Clemson University

As of July 1, 2017:

- Barbara Ramirez, *Assistant Editor*
- Teri Garrett, *Administrative Assistant*

Thank you to the members of the JEE Editorial Board for their service!

Deputy editors: Maura Borrego; Cindy Finelli (as of July 1)

Senior associate editors: Shane Brown, Jeff Froyd, Lisa Lattuca, Barbara Moskal, Jim Pellegrino

Associate editors: Olusola Adesope, Alan Cheville, Jenefer Husman, Nadia Kellam, Susan Lord, Khairiyah Mohd-Yusof, Marie Paretti, Ruth Streveler

ASEE publishes JEE in partnership with John Wiley & Sons

Wiley handles

- Institutional subscriptions
- Typesetting, artwork
- Online access, search

ASEE members can access JEE at www.jee.org via www.asee.org login

...and more

engineering education community resource

http://bit.ly/engredu

COLLEGE OF ENGINEERING
ENGINEERING EDUCATION RESEARCH
UNIVERSITY OF MICHIGAN

Ph.D. and M.S. in Engineering Education Research just approved at University of Michigan!

College-wide programs in UM's graduate school

B.S. and M.S. in engineering required for admissions

Applications accepted starting Fall 2017

First students enroll in Fall 2018

Multiple openings for postdocs, teaching fellows, and research assistants - email us

Shanna Daly

Mechanical Engineering

Research interests

- Design & creativity
- Idea generation
- Returning students

Cindy Finelli

Electrical Engineering & Computer Science; Education

Research interests

- Teaching & learning
- Classroom design
- Innovative technology in the classroom

Aileen Huang-Saad

Biomedical Engineering

Research interests

- Engineering entrepreneurship education
- Instructional change in biomedical engineering

Lisa Lattuca

Education; Integrative Systems & Design

Research interests

- Teaching & learning
- Curriculum design & assessment
- Interdisciplinarity

Joi Mondisa

Industrial & Operations Engineering

Research interests

- Mentoring & underrepresented populations
- Resilience, grit, & persistence

http://eer.engin.umich.edu

eerprogram@umich.edu

TEXAS STATE®

LBJ INSTITUTE FOR STEM EDUCATION AND RESEARCH

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Dr. Leslie Huling & Dr. V. Sriraman,
Senior Advisors, LBJ Institute for STEM Education & Research
Professors, Texas State University

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The LBJ Institute for STEM Education & Research

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LBJ Institute for STEM Education and Research

Leadership Team


Araceli Martinez Ortiz, Ph.D.
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Ed Research Consultant

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Kimberly Talley, Ph.D, P.E.
Maker Space Co-Director


Debra Feakes, Ph.D.


Mina Guirguis, Ph.D.


Clara Novoa, Ph.D.


Susan Morey, Ph.D.


M. Alejandra Sorto, Ph.D.


Austin Talley, Ph.D.


Bahram Asiabanpour, Ph.D.

Over $22M in Research Grant Funds awarded 2014-2019

NASA EPDC STEM Educator Professional Development Collaborative

$15M for 5 Years/2015-2020
PI: A. Martinez Ortiz
Co-I's: L. Huling,
Asiabanpour, Bos, Close, Jensen, Lee, Sorto, Sriraman

Partners:
California State University- Northridge Norfolk State University, North Carolina Central University, Penn State University-Center for Online Innovation in Learning, Salish-Kootenai College, University of South Florida, & U.S. Satellite.

- A national, diversity-focused professional development system that leverages NASA assets and resources to support Educator excellence in STEM Education.
- EPDC provides a multitude of face-to-face and online professional development opportunities and NASA resources for educators in K-12, university, and community settings.
- The key PD experts who deliver this training are 10 Educator Specialists located at 10 NASA Space Research Centers.

The STEM Teacher Excellence Project (STEP) [NASA MEI]

$2.9M for 3 Years/2015-2018
PI: L. Huling/ Co-I: A. Martinez Ortiz

Partners:
10 NASA Centers/ 10 Educator Specialists

- Program will offer one-week Institutes to pre-service and alternate route STEM teachers at each of the 10 NASA Centers beginning in 2016 to serve a minimum of 50 participants who will be recruited from Minority Service Institutions (MSIs) from around the country.
- Collectively over the3 years of the project, the 30 NASA STEP Institutes will provide a minimum of 1500 STEM educators with a series of content-rich NASA professional learning experiences and will impact all 10 NASA Centers across the U.S. Research Efforts will follow.

Future Aerospace-Engineers and Mathematicians Academy (FAMA) [NASA MAA]

- (FAMA) program offers early space-based STEM learning experiences for upper elementary and middle school students [summer pre-engineering camps], family outreach [with bilingual resources] , and professional development for pre-service teachers.

$400k for 3 Years/2015-2018
PI: A. Martinez Ortiz
Co-I: L. Rodríguez, H. Warshauer & A. Sorto

An Aerospace Education Laboratory (AEL) will be established at Centro and equipped with computers, laptops, cellular-based devices and educational robotics kits to enhance the technological literacy development of program students.

Partners:
San Marcos Consolidated Independent School District (SMCISD); Centro Cultural Hispano de San Marcos (Centro).

NSF STEM Rising Stars

$1.5M for 4 Years/2015-2019
PI: A. Martinez Ortiz

Co-Principal Investigators:
Kimberley Talley, Clara Novoa; Mina Guirguis; Eleanor Close; **Senior Personnel: Leslie** Huling; Vedaraman Sriraman; Debra Feakes; Alejandra Sorto, Susan Morey

- The team will design, develop and implement a set of effective STEM learning and teaching practices aimed at producing significant improvements in freshman and sophomore major retention rates and graduation rates in chemistry, computer science, engineering, engineering technology, mathematics and physics.

The Engineering Education Maker Identity Project

$300k for 4 Years/2015-2019; PI: A. Martinez Ortiz

Co-Principal Investigators: Kimberly Talley, Shaunna Smith, & Vedaraman Sriraman

- Engineering Education Research regarding the impact of Maker Spaces , STEM learning and teaching practices.

Collaborative Research: University Maker Spaces: Discovery, Optimization and Measurement of Impacts

$75k for 4 Year/2014-2018; PI: K. Talley

Select Research Focus Areas

K-12 Students

- Parental involvement and impact upon student career readiness and decisions
- Impact of early integrated STEM educational experiences (cognitive and affective)
- Engineering Education based K-12 curricula

University Students

- Strategies to support STEM student retention
- Creativity and Innovation
- Makerspaces' impact upon student learning
- STEM professional identity development
- Gender issues in STEM studies
- Alternative Instructional Models

Teachers

- Best practices in STEM education for Diverse Audiences
- Effective models for STEM professional development
- Empowerment by Learning to use instructional technologies
- Culturally Responsive Teaching in STEM
- Digital Badging and Online learning

Teacher Educators

- Research in course redesign and Instructional approaches in physics, chemistry, mathematics, computer science, engineering and engineering technology
- Scholarship of Teaching and Learning

Educational Systems

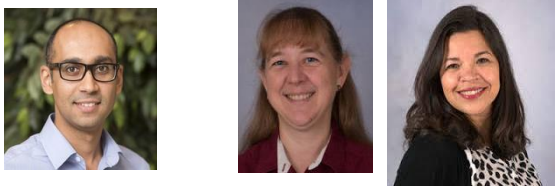
- Collective Impact case studies
- Longitudinal assessment methodologies
- Engineering, Ethics and Social Justice
- Global research and education in STEM

NSF TxST STEM Rising Start Project

(2015-2018)-Four Major Strategies

To research the impact of interventions that produce significant improvement in freshman and sophomore major retention rates and graduation rates in chemistry, computer science, engineering, engineering technology, mathematics, and physics.

Figure 1. *Texas State STEM Rising Stars* Organizing Framework for the program's implementation strategies



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Early Outreach & Research with K-12 Pre-Engineering Students

NASA FAMA Future Aerospace-engineers & Mathematicians Academy

NASA EPDC STEM EDUCATOR PROFESSIONAL DEVELOPMENT COLLABORATIVE

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INFORMAL EDUCATORS

In addition to K-12 and university educators, other professionals in our society fulfill an educational role in providing clients with important learning opportunities. The informal educator who works in community organizations, after school and summer programs, or museums are examples of such professionals that NASA STEM EPDC is committed to serving.

PRE-SERVICE TEACHERS

Pre-service teachers—or students in educator prep programs—strengthen their content knowledge in STEM and build their portfolio of skills and resources when they become involved with the NASA STEM EPDC program. This builds their confidence to create a more impactful STEM education experience in their future classrooms.

IN-SERVICE TEACHERS

The responsibility to inspire students to pursue careers in STEM fields largely depends on the guidance of the K-12 teacher. The NASA STEM EPDC program aims to guide these in-service teachers toward a wealth of resources to enhance their teaching of STEM subjects and sound culturally responsive teaching approaches.

UNIVERSITY FACULTY

The preparation of K-12 STEM teachers seems to yield the greatest benefit when collaborating with faculty from departments of Science, Technology, Engineering, Mathematics, and Teacher Education. The dedication and work of these faculty is critical to encourage and nurture the young minds of the workforce of tomorrow.

LinkEngineering

- Intended to support implementation of preK-12 engineering education
- Interactive online community
- Platform allows
  - Posting of events or resources
  - Ability to rate resources or ask questions
  - Ability to ask questions of the community
- Goals of the site
  - Create a community of practice
  - Provide high-quality resources

LINKENGINEERING BETA
EDUCATOR EXCHANGE
LINKING PREK-12 TO EXPERTISE AND CONTENT

NATIONAL ACADEMY OF ENGINEERING

Chevron
Human Energy™

https://www.linkengineering.org/

Questions? Contact Beth Cady at ecady@nae.edu

...and more

engineering education community resource

http://bit.ly/engredu

Documenting Impact of Purdue's School of Engineering Education

Audeen Fentiman and Teresa Walker

EER&I Networking Session

June 27, 2017

PURDUE UNIVERSITY

ENGINEERING EDUCATION

What, Where, When, and How

- What
  - History (including demographic trends)
  - Leadership
  - Innovations in Education
  - Research
  - Growing the Community
  - Indirect Impact
    - Numbers and demographics of practicing engineers
    - Quality of their preparation
- Where
  - On our website
- When
  - Ongoing – not yet public
- How
  - General overview of direct impact on one page
  - Increasing levels of detail on supporting pages
  - Indirect impact – working on it

Measures of Leadership

- Professional societies
  - Committee and division officers
  - Fellows
- Editorships
- National workshop leadership (e.g. NAE, NSF)
- Advisory board membership
- Student leadership roles

Innovations in Education

- First-Year Engineering
  - Changes made (based on research)
  - FYE as a laboratory
  - Instructional process innovations – to deliver courses at scale
- Multidisciplinary/Interdisciplinary Engineering
  - New degree programs incubated in MDE
  - Innovations in MDE/IDE courses
- Graduate Education
  - Ph.D. program content
  - Graduate certificate
- Collaboration with other engineering schools at Purdue
  - Innovations in other schools
- Teaching awards

Research

- Major research categories (link to faculty research descriptions)
- Research funding
  - Amounts
  - Diversity of sources
- CAREER and PECASE awards
- INSPIRE research in P-12
- Research summits hosted
- Research dissemination
  - Journal publications
  - Conference papers
  - Best paper awards in journals
  - Best paper awards at conferences
- Invited presentations
  - US
  - International

Growing the Community

- Where our Ph.D. grads go (map)
  - Location
  - Position
  - Impact
- Where our postdocs and visiting faculty go
- Former Purdue ENE faculty providing leadership elsewhere
- Impact of INSPIRE
  - Number of teachers participating in research, activities
  - Number of students affected
  - Informal education activity participation
- Collaborations with other institutions
  - US
  - International

Indirect Impact on Preparation of Engineers

- Probably the most difficult impact to measure – and most important
- Trends in the numbers at a particular institution
  - Number of students graduating with engineering degrees
  - Percentage of beginning students finishing an engineering degree
  - Average time to degree
  - Net number of students transferring into engineering – and finishing
  - Percentage of women in beginning and graduating classes
  - Percentage of URM in beginning and graduating classes
  - Percentage of engineering graduates still in the field after 3, 5, 10 …years

Indirect Impact on Preparation of Engineers

- More difficult to measure
  - Quality of the engineering education & quality of the students' educational experience
  - Impact of quality of education & quality of educational experience on trends on previous slide
  - Impact of engineering education research on quality of education & quality of educational experience
    - At the university with an Engineering Education department
    - At other universities

RIGOROUS RESEARCH in ENGINEERING EDUCATION

Funded by the National Science Foundation through awards DUE 0341127 and DUE 0817461

Rigorous Research in Engineering Education (RREE)

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Update

- Resources
  - CLEERhub has moved
  - https://stemedhub.org/groups/cleerhub
  - Googling CLEERhub will take you to this site!
- Space to build methods and theories in EER
  - https://ruthstreveler.wordpress.com/engineering-education-research/ [link from Purdue ENE website]

RIGOROUS RESEARCH in ENGINEERING EDUCATION

“Research Briefs”

NEW PODCAST ABOUT EER

FIRST MONDAY OF EVERY MONTH
STARTING SEPTEMBER 2017

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Questions? Contact Streveler@purdue.edu

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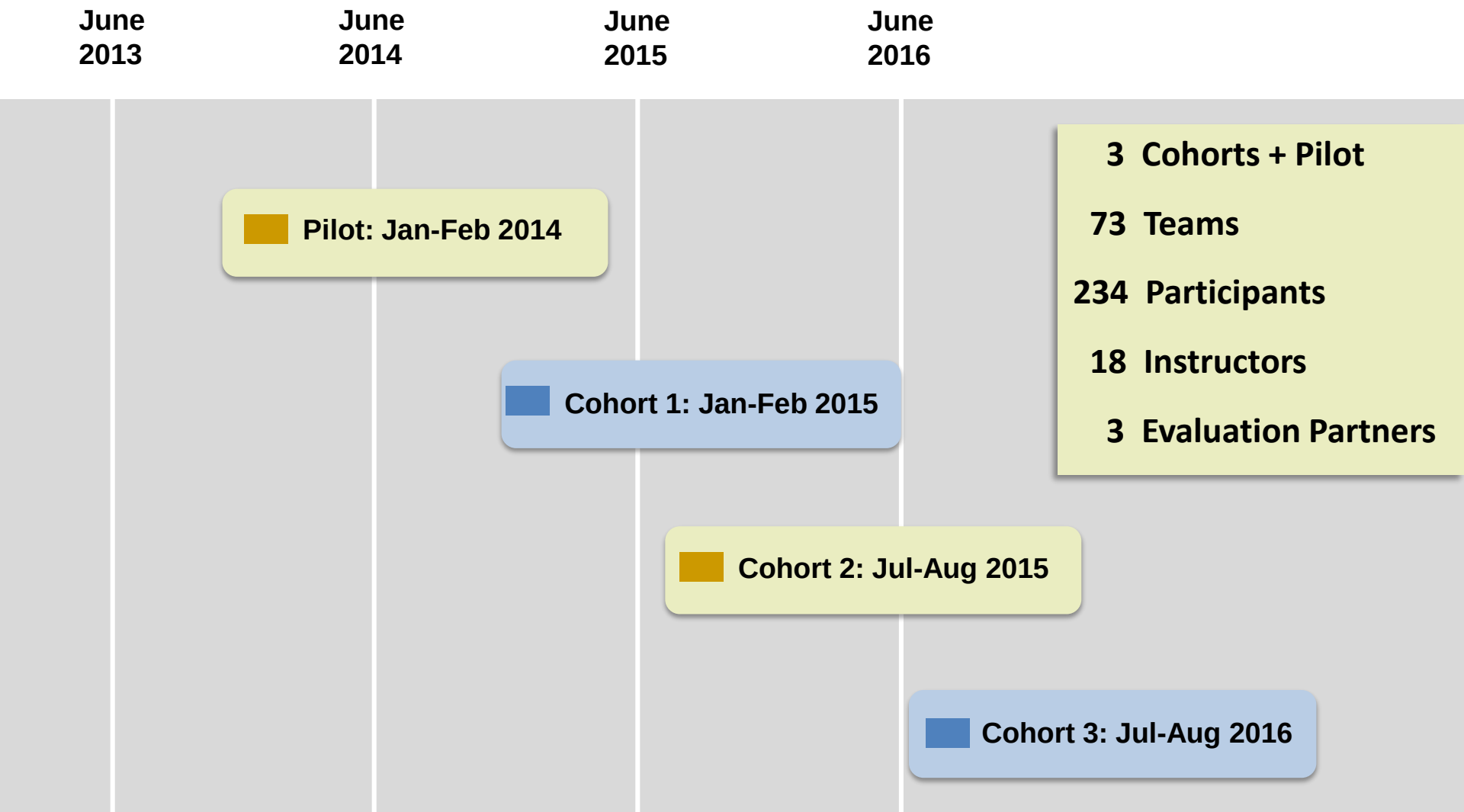
Evidence-based Entrepreneurship™ to Improve STEM Education

www.asee.org/i-corps-l

I-Corps™ for Learning History



Current Initiatives

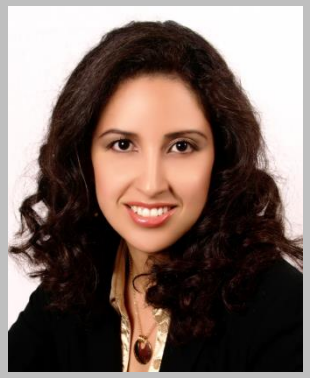
Awareness Sessions	Smart Start (Introduction to I-Corps™ L)	National Cohort
1-3 hours	2 weeks	7 weeks
Face-to-Face Online	Online Hybrid	Hybrid
• Introduction to core features of the Lean Startup Process • Focus on the importance of sustainable scalability at the early stages of concept development	• Opportunity to develop 'proof-of-concept' evidence towards sustaining and scaling • Focus on Value Proposition + Customer Segment 'fit'	• Opportunity to determine innovation readiness for sustainable scalability • Immersion in the Lean Startup Process
League for Innovation Learning Summit – June 2017 **Frontiers in Education (FIE)** October 2017, Indianapolis, IN	***ASEE Annual Conference** June 25-28, Columbus, OH	**??** (traditionally Jul-Aug)

Lean Startup Approach

to Design Impact-Driven Education Projects

Learning Summit 2017– June 14, 2017 – 8:00 – 8:45 am

Ashok Agrawal
American Society for



Rocio Chavela Guerra
American Society for

Karl A. Smith
Purdue University and

SMART START

DESIGNING IMPACT-DRIVEN PROJECTS

ABOUT THE COURSE

This no-cost, two-week course is designed for researchers and innovators who want to deepen the impact of a project, product, or program to improve STEM education at any level in both formal and informal settings. When you accept the challenge, you will:

- Identify the audience for your innovation and expand your research impact.
- Learning how to develop an effective proof-of-concept, saving time and resources.
- Awaken your inner entrepreneur.
- Become more aware of the needs of others and seek efficient ways to address them.
- Decide whether a rigorous, 8-week training like NSF I-Corps™ or I-Corps™ for Learning (I-Corps™ L) is right for you.

HOW TO APPLY

1. **Check eligibility and application process on the website:**
   https://www.asee.org/i-corps-l/events/smart-start

2. **Prepare an online application that addresses the following:**
   - Brief description of your STEM learning innovation.
   - Summary of evidence supporting innovation (e.g. documented learning outcomes) and any proof of concept data (implementation results).
   - List of (up to three) team members, including their connection with the innovation (e.g., principal investigator, graduate student researcher, etc.).
   - Confirmation of team members' willingness to commit to the two-week course, including attending all meetings and conducting customer discovery interviews.

3. **Submit an application at**
   https://www.surveymonkey.com/r/smartstartApp

Evaluation Team

Gary Lichtenstein

Quality Evaluation Designs
Education Research, Evaluation, Policy
GARY LICHTENSTEIN, ED.D.

Cathleen Simons

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GARY LICHTENSTEIN, ED.D.

Lynette Parker

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Education Research, Evaluation, Policy
GARY LICHTENSTEIN, ED.D.

Sheri Sheppard

Stanford
University

I am NOT an entrepreneur: Exploring the motivations, contexts, and ecosystems within which engineering education faculty sustain and develop their learning innovations.

Hypotheses:

H1: There are professionals whose primary goal for innovating is to make a positive impact in society; they don't have (much) experience in business nor aspire to be entrepreneurs.

H2: Most of these professionals do not a) expect to make a ton of money from their innovations, b) plan on leaving their jobs, and c) stop being dependent on grants (although they might be open to other funding streams as well).

H3: These people may not think of themselves as entrepreneurs, but they already use strategies—or would be intrigued to use strategies—that successful entrepreneurs do to sustain their innovations beyond a grant cycle and expand the impact and reach of their work.

Gary Lichtenstein
Email: Gary.Lichtenstein@asu.edu

Ira A. Fulton Schools of Engineering
Arizona State University

Quality Evaluation Designs
Highest Quality · On Time · On Budget

Interviewing I-Corps™ L alumni 8-30 months after the course

Motivation	Context	Ecosystem
Entrepreneurial Leaning Vs. **Current Profession Leaning** Vs. **Both Equally**	**Was a company formed?**	**Are buyers & decision-makers more than 2 people?**
	How/where does revenue flow?	**Buyers and decision-makers can be found based on job title, group affiliation, or geographical location…**
	Intention to Grow?	**Threats from competitors?**
	Are there Plans to Scale; if so, are they specific and shared?	**PRIMARY Channels?**
	Anticipated Revenue/year after 5 Years	**Regulatory agencies required?**
	Does PI have and/or desire Business Support?	

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Quality Evaluation Designs
Highest Quality · On Time · On Budget

I-Corps L Longitudinal Study funded by NSF EAGER #551463

Ira A. Fulton Schools of Engineering
Arizona State 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)

- **Reflect on your interests and plans for engineering education research & innovation**
- **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, 2017

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

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Facilitated By

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