EER&I Networking Session

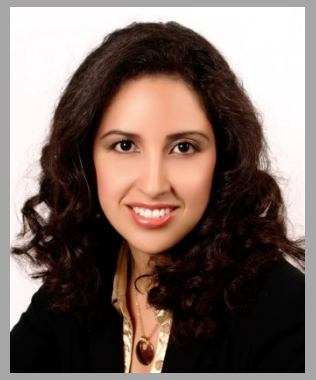
Connecting and Expanding the Engineering Education Research & Innovation (EER&I) Communities

ASEE/IEEE Frontiers in Education Conference – October 22, 2015 – T1A – 11:00 pm – 12:30 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**
Brief report on status of EER&I	**25 min**

- Update on Departments, PhD programs, and Centers
- Update on EER initiatives – NRC DBER, ASEE VCP
- Update on EEI initiatives – NAE FOEE & NSF I-Corps L

Participant Networking	**30 min**

- Rapid introductions around guided questions – Four to five 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

Brainstorming on strategies to connect, expand, and sustain the emerging EER and EEI communities	**20 min**

- Summary of ideas for (a) local, (b) national – conferences, etc. and (c) virtual community
- Individuals share reflections with the large group, facilitators sum up the session and participants complete feedback forms

ENGINEERING
EDUCATION
and
LEADERSHIP

The Pathway to Establishing a Department

Grounded in UTEP's designation as a NSF Model Institution of Excellence (1995) . Launches a twelve-year transformation of STEM education (1995 – 2007).

ENGINEERING

2007

Inaugurate a Center for Research in Engineering & Technology Education

ESTABLISHED TO *INSPIRE, INNOVATE & IMPACT* ENGINEERING EDUCATION

UTEP ENGINEERING

2008

Today Engineering Tomorrow
Whole College of Engineering
Workshop

CREATE

CONCENSUS FOR *TRANSFORMING* UTEP ENGINEERING EDUCATION IN THE NATIONAL CONTEXT OF CALL FOR REFORM

ENGINEERING

2010 - 2011

Leadership for the Conceptual Age Engineering Lecture Series

ENGINEERING:
LEADERSHIP FOR THE CONCEPTUAL AGE
Engineering Lecture Series

Exploring The Conceptual Age and *LEARNING & BUILDING* plans for UTEP's new programs to Prepare Conceptual Age Leaders

UTEP ENGINEERING

2012 - 2013

Partnership with Olin College – Sharing Capacity for Development of Student-Centered Experiential Learning Paradigms

CREATE

FACULTY IMMERSION AT OLIN, WORKSHOPS, OLLABORATORY, JOINT PLANNING AND REGULAR VISITS OF OLIN FACULTY TO UTEP

Department of Engineering Education & Leadership

ENGINEERING
EDUCATION
and
LEADERSHIP

eel.utep.edu

2014 - 2015

FORMAL DEPARTMENT eel.utep.edu ESTABLISHMENT and NEW DEGREE PROGRAMS APPROVED

Engineering Education at The Ohio State University

Engineering Education Innovation Center (EEIC) (established 2007)

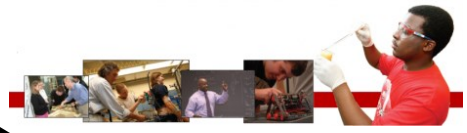
Engineering Graphics

1st Year Engineering

Engineering Sciences Minor

Multidisciplinary Capstone

Instructional Technology



Department of Engineering Education (pending approval Nov. 2015)

Enhanced EEIC

+

Innovative Graduate Program,

Game Changing Research

Groundbreaking Collaborations

Website: https://engineering.osu.edu/eeic

Current Efforts

- Faculty Hiring (Assistant, Associate, and Full Profs) (First Hires Fall 2016)
- Graduate Student Recruitment (First Cohort Enrollment in Fall 2016)
- Unique Opportunities
  - Create a department informed by the known strengths, weaknesses, opportunities, and threats within current engineering education departments and centers
  - Connect deliberately to engineering disciplines in an effort to produce graduates who are technically and educationally competent and to strengthen engineering education and disciplinary connections
  - Emphasize professional skills development across the engineering education curricula
  - Develop emerging engineering education research areas that advance the field and meet the needs of broader society
  - Create innovative curricula to attract and retain diverse students in engineering
  - Offer engineering education specializations in areas such as Higher Education, Public Policy, and professional fields (e.g., Law or Medical Education)
- For more information, contact: christy.14@osu.edu

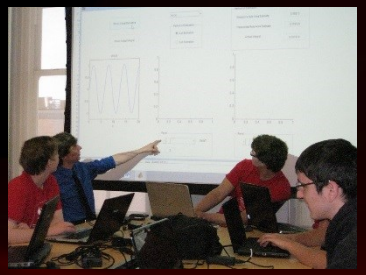
THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

COLLEGE OF **ENGINEERING** & **APPLIED SCIENCE**

DEPARTMENT OF **ENGINEERING EDUCATION**

First-Year Engineering Experience:

Three courses offered to all first-year engineering students focusing on hands-on experience and bridging knowledge areas through computing



Alumni Engineering Learning Center:

Newly renovated facility featuring state-of-the-art classrooms and a variety of collaborative learning spaces

High School Teacher Preparation:

Newly offered certificate program aimed at preparing high school teachers to introduce engineering and address the Next Generation Science Standards

Preparation for Future Faculty:

Certificate program being developed to prepare current graduate students for a career in academia, focusing on pedagogical development and the scholarship of teaching and learning

Leaders in Innovative Pedagogy:

Courses offered by DEE have become a testbed for new and innovative pedagogies, such as flipped classrooms and experiential and challenged-based learning

Learn more!

http://ceas.uc.edu/dee

WE ENGINEER BETTER™

UNIVERSITY OF Cincinnati

UNIVERSITY OF Cincinnati

COLLEGE OF **ENGINEERING & APPLIED SCIENCE**

Department Head Position
Department of Engineering Education

The **Department of Engineering Education** in the College of Engineering and Applied Science at the University of Cincinnati invites applications for the position of **Department Head.** The principal responsibility of this position is to provide leadership and management of the department including responsibility for planning, fiscal management, human resources, and departmental communications. The Department Head is expected to advance the research and teaching missions of the department, nurture collaborations across the college and campus, and work to achieve departmental, college, and university strategic goals.

For more details and to submit an application, please visit:
https://career8.successfactors.com/sfcareer/jobreqcareer?jobId=5701&company=UCPROD&username

Application must include a cover letter, curriculum vitae, a statement of experience, vision, and leadership and at least three references. References will only be contacted for those candidates who are selected for the short list. Applications will be reviewed on a rolling basis until the position is filled.

WE ENGINEER BETTER™

UC is an affirmative action/equal opportunity institution.

The University of Cincinnati does not discriminate on the basis of disability, race, color, religion, national origin, ancestry, medical condition, genetic information, marital status, sex, age, sexual orientation, veteran status or gender identity and expression in its programs and activities. The complete Notice of Nondiscrimination can be found at http://www.uc.edu/about/policies/non-discrimination.html.

University of Michigan
Center for Research on Learning and Teaching in Engineering

Learning Communities

PRACTICE

CRLT-ENGIN
UNIVERSITY OF MICHIGAN

RESEARCH

Original Research

Faculty & GSI Development

Ph.D Certificate
for Engineering Education Research

crlte.engin.umich.edu

University of Michigan
Engineering Education Research (EER)

Next steps

- Multiple tenured/tenure-track **faculty positions** in EER currently posted
- College-wide EER **PhD program** under development
- **Community building** initiatives underway and more planned

cfinelli@umich.edu

PURDUE UNIVERSITY **PhD in ENGINEERING EDUCATION**

WE RESEARCH **HOW ENGINEERING IS**

BEST TAUGHT LEARNED PRACTICED

First PhD Program
26 Faculty
32 Staff
60 PhD students
66 graduates
State-of-the-Art Research Lab

GRADUATE OPEN HOUSE
OCTOBER 28-29, 2015

- Learn about our PhD program
- Meet our faculty and students
- Attend our weekly research seminar
- Tour the campus and facilities

purdue.edu/ENE/InfoFor/GraduateStudents

PURDUE
UNIVERSITY

ENGINEERING EDUCATION

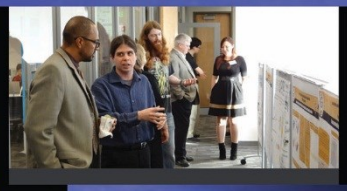
BIG QUESTIONS IN ENGINEERING EDUCATION RESEARCH

School of ENGINEERING EDUCATION

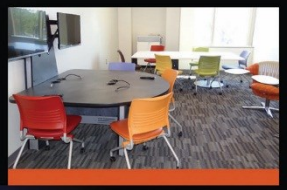
PURDUE UNIVERSITY

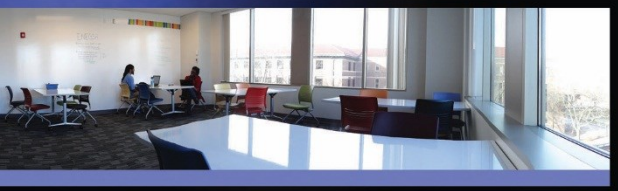
Interdisciplinary Engineering Education Research Laboratory

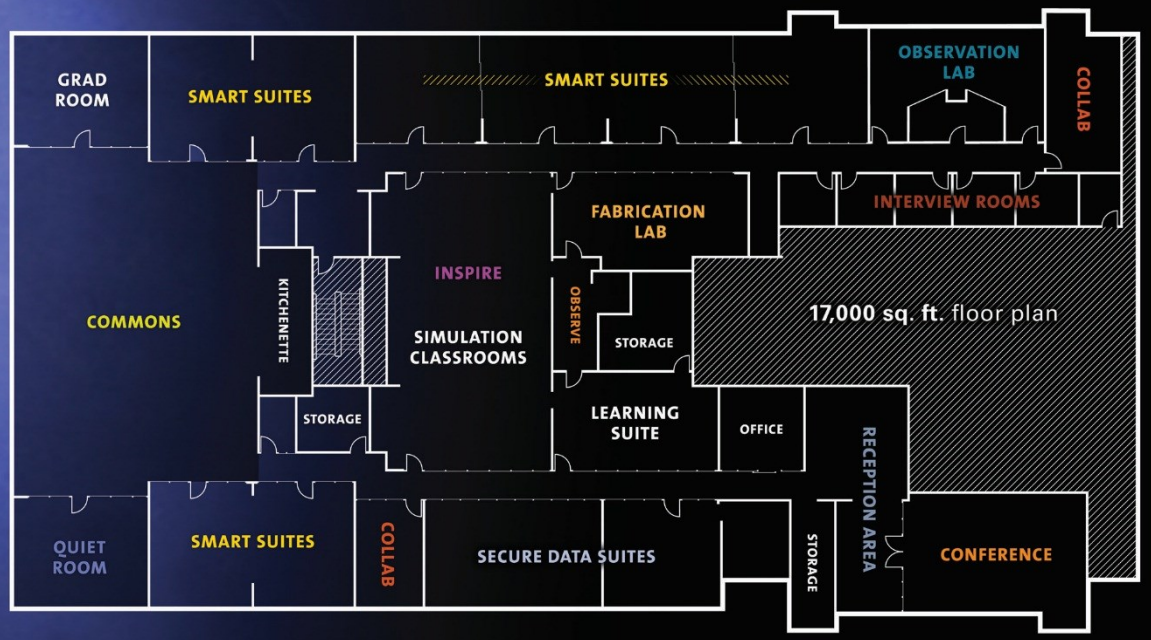


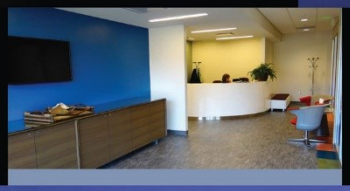









State-of-the-Art Research Lab

Engineering Education Community Resource

A web catalog for the international engineering education community, including…

- Degree programs and centers
- Societies, conferences, and journals
- Job listings

http://bit.ly/engredu

Discipline-Based Education Research (DBER) Report

National Research Council Summer 2012 – http://www.nap.edu/catalog.php?record_id=13362

LAST WORD — OPINION BY SUSAN SINGER & KARL SMITH

Follow the Evidence

Discipline-based education research dispels myths about learning and yields results – if only educators would use it.

Last year, the National Research Council released the report *Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering*. That consensus study, on which we served as committee members, brought together experts in physics, chemistry, biology, the geosciences, astronomy, and engineering, as well as higher education researchers, learning scientists, and cognitive scientists to focus on how students learn in particular scientific and engineering disciplines. Our key conclusion: Findings from the growing field of discipline-based education research (DBER) have yet to spur widespread changes in the teaching of science and engineering.

For example, research-based instructional approaches to teaching that actively engage students in their own learning, such as group projects, have been shown to be more effective than traditional lectures. Yet science and engineering faculty still cling to familiar practice. While there's no magic solution for adopting evidence-based teaching practices, finding out what is known about undergraduate learning in engineering and science—and identifying impediments to implementation in the classroom—can point the way.

First, many students have incorrect understanding about fundamental concepts—particularly phenomena that are not directly observable, such as those involving very large or small scales of time and space. Understanding how educators can help students change these misconceptions is in the early stages, but DBER has uncovered some effective instructional techniques. One promising approach is to use "bridging analogies" that link students' correct knowledge with the situation about which they harbor false beliefs. For instance, a student may not believe that a table can exert a force on a book resting on its surface but accepts the notion if a spring is placed under the same book. Linking these two ideas, with perhaps an intermediate of a book resting on a foam block, can move the student toward a correct understanding of forces.

STUDENTS ARE CHALLENGED BY KEY ASPECTS OF ENGINEERING AND SCIENCE THAT CAN SEEM EASY OR OBVIOUS TO EXPERTS.

Students also are challenged by important aspects of engineering and science that can seem easy or obvious to experts. When tackling a problem, for instance, students tend to focus on the superficial rather than on its deep structure. Instructors may have an "expert blind spot" and not recognize how different the student's approach is from their own, which can impede effective instruction. Several strategies appear to improve problem-solving skills, such as providing support and prompts—known as "scaffolding"—as students work their way through problems. Another common issue for students in all disciplines is difficulty in extracting information from graphs, models, and simulations. Using multiple representations in instruction is one way to move students toward expertise.

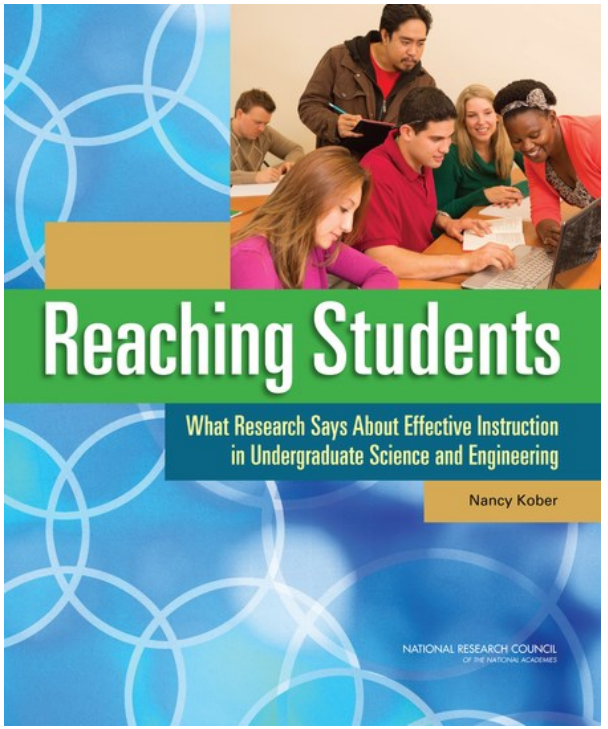
The report recommends future DBER research that explores similarities and differences in learning among various student populations, and longitudinal studies that shed additional light on how students acquire and retain an understanding (or misunderstanding) of concepts. However, we also need strategies that translate the findings of DBER and related research into practice. That includes finding ways around barriers, such as the faculty reward system, the relative value placed on teaching versus research, lack of support for faculty learning to use research-based practices, problems with student evaluations, and workload concerns.

The report urges universities, disciplinary organizations, and professional societies to support faculty efforts to use evidence-based teaching strategies in their classrooms. It also recommends collaboration to prepare future faculty members who understand research findings on learning and teaching and who value effective teaching as part of their career aspirations. By implementing these recommendations, engineering and science educators will make a major first step toward using DBER to improve their practice—and learning outcomes.

Susan Singer, the Laurence McKinley Gould Professor of the Natural Sciences at Carleton College, chaired the National Research Council committee that prepared the consensus study. Karl Smith, the Cooperative Learning Professor at Purdue University's School of Engineering Education and emeritus professor of civil engineering at the University of Minnesota, represented engineering on the committee. To view the report, visit http://www.nap.edu/

ASEE *Prism Summer 2013*

Journal of Engineering Education – October, 2013



National Research Council – 2015 http://www.nap.edu/catalog/18687/reaching-students-what-research-says-about-effective-instruction-in-undergraduate

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

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

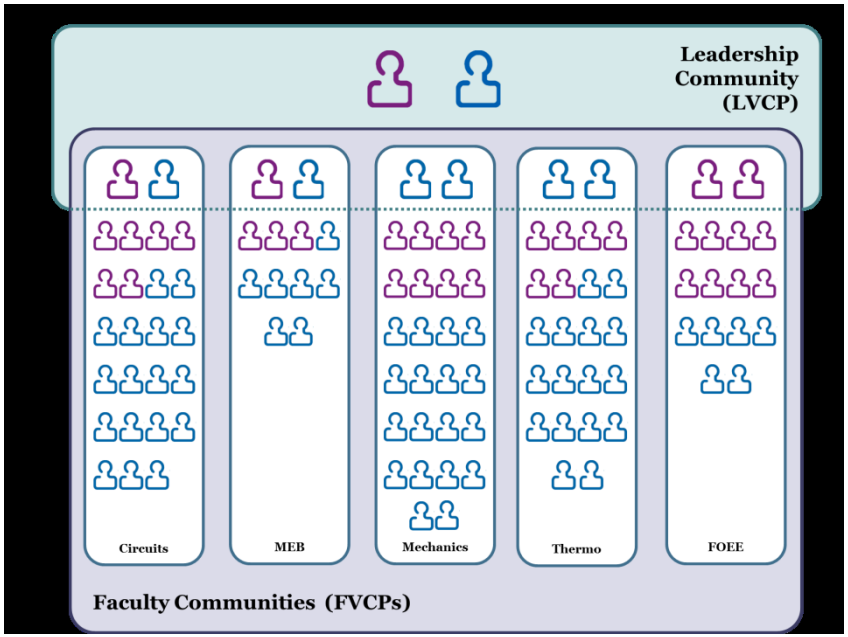
FACULTY DEVELOPMENT USING VIRTUAL COMMUNITIES OF PRACTICE

NSF Award DUE-1224217

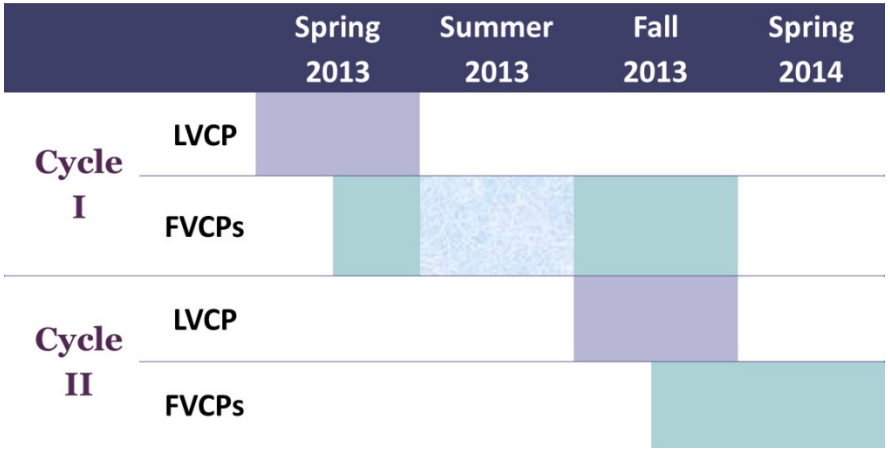
http://vcp.asee.org/

VCP Model for Faculty Development

- Two-tier structure
  - **First tier: Leadership VCP** – trains the leaders of the second tier
  - **Second tier: Faculty VCPs** – two leaders head each faculty VCP



- Two preparation cycles
  - Knowledge building phase and practical phase



NATIONAL ACADEMY OF ENGINEERING

OF THE NATIONAL ACADEMIES

Engineering Education Research and Innovation Programs Update

Beth Cady, Program Officer, NAE
ecady@nae.edu

Frontiers of Engineering Education (FOEE)

- Brings together engineering faculty members doing innovative teaching activities in their classrooms to:
  - Recognize their accomplishment
  - Broaden collaborations between faculty members/institutions
  - Promote the dissemination of innovative practices
- Invited Attendees are nominated by their dean or an NAE member, apply, and are selected by the FOEE Advisory committee.

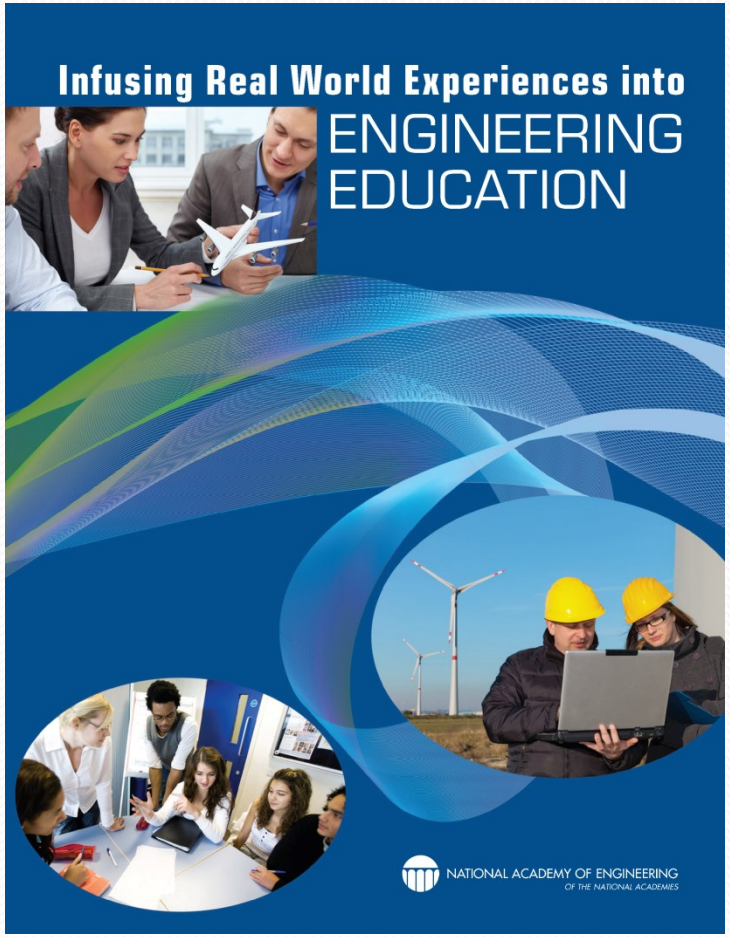
Frontiers of Engineering Education

- Since 2009, 384 individuals from 127 institutions have attended FOEE.
- 7th Symposium is at end of October in Irvine, CA

- Nominations will open in spring, 2016. If you are interested in attending please talk to your dean about nominating you.

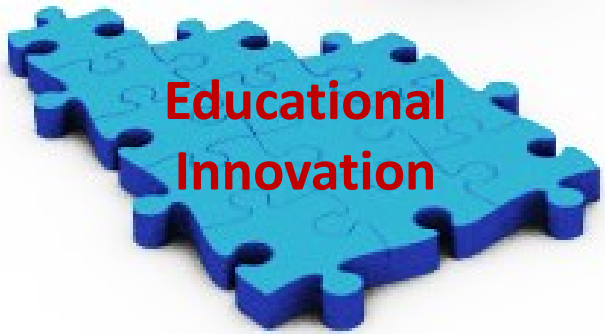
- For more info: http://naefoee.org/

Infusing Real World Experiences into Engineering Education



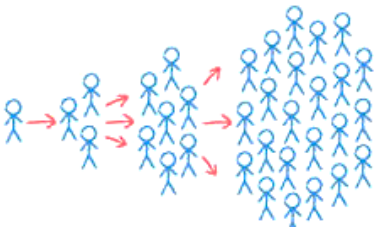
- 29 exemplar programs that provide students with real-world experiences
- Includes a discussion on potential barriers and ways of overcoming them
- Also available at www.nap.edu

Innovation Corps for Learning



Experiential Program

Readiness to Sustain & Scale



NSF I-CORPS NSF Innovation Corps · ASEE · University of Minnesota · ASU Arizona State University · Tufts University · Colorado State University

I-Corps™ L History

June 2013 | June 2014 | June 2015 | June 2016 | ?

June 2013: Called to Serve

Jan-Feb 2014: Pilot Cohort

Mar-Nov 2014: Redesign

Jan-Feb 2014: Full Cohort

Mar-May 2015: Redesign

Jul-Aug 2015: Full Cohort

Jan-May 2016: Redesign

Jul-Aug 2016: Full Cohort Planned

Program Overview (7-8 weeks)

Kickoff Workshop	Online Sessions	Closing Workshop
• Three-day curriculum immersion	• Five weekly sessions	• Two-day lessons learned & next steps showcase

Business Model Canvas (BMC) Discussions

Customer Discovery (Get Out of the Building)

Team Presentations (& Feedback)

THE GROWING NETWORK OF I-CORPS™ L TEAMS

TAKING YOU FROM AN IDEA TO A BUSINESS (SUSTAINABLE SCALABILITY)

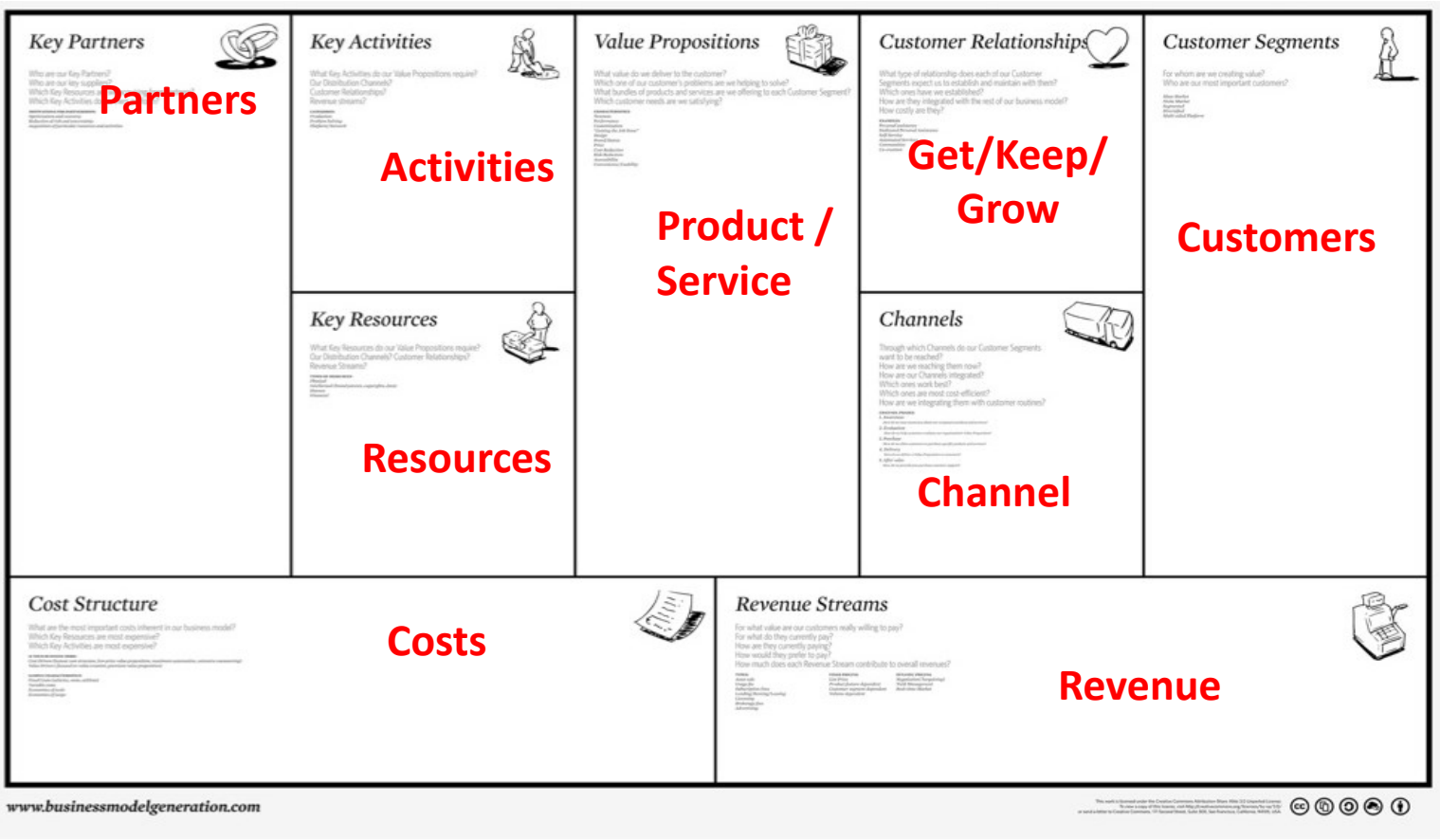
The Lean Startup In Three Steps

1. Frame Hypotheses

- Frame Hypotheses ➔

1. Frame Hypotheses

- Frame Hypotheses ➔ Business Model Canvas

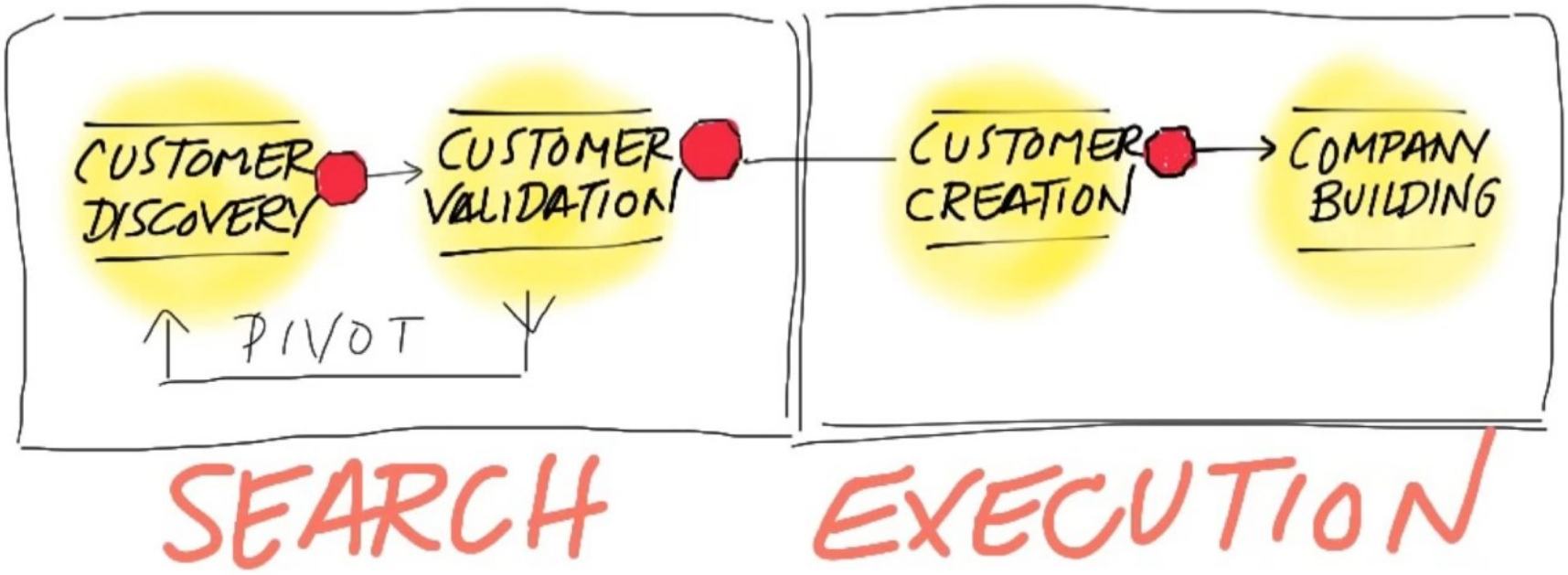


2. Test Hypotheses

- Frame Hypotheses ➔ Business Model Canvas
- Test Hypotheses ➔

2. Test Hypotheses

- Frame Hypotheses ➔ Business Model
- Test Hypotheses ➔ Customer Development



3. Build Incrementally & Iteratively

- Frame Hypotheses ➔ Business Model
- Test Hypotheses ➔ Customer Development
- Build the product incrementally & Iteratively ➔ Agile Engineering

Value of I-Corps L (participants' testimonials)

For their learning innovation...

- "I was really skeptical…I have learned an amazing amount already and look at things very differently than I did two weeks ago"
- "A scientific approach to customer discovery framed within the construct of the business model canvas provides a potentially transformative perspective to propagation of innovations"
- "All faculty who engage in research/funded activities should know this"

And beyond...

- "Already applying it to other projects"
- "Out of my comfort zone, a good challenge"
- "Opens doors to people we wouldn't normally get to meet"
- "Got an idea of how to use it in my teaching..."

Participant Networking Activity (~25 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**

Next Steps (~ 5 min)

- **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 FIE conference and beyond**
  - EER&I Networks – CLEERhub, REEN, SEFI, National Innovation Network (NIN)
  - Meet again at ASEE Conference, June, 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/IEEE Frontiers in Education Conference 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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