Founding stories of engineering entrepreneurship programs: Research to inform practice
Helen L. Chen, Carolyn Estrada, Shannon Gilmartin, Angela Shartrand, Sheri Sheppard
epicenter.stanford.edu

You have two index cards in front of you…

What is your burning question about…
1. how to create an entrepreneurship program?
2. how to grow an entrepreneurship program?

Please put your name on the back of each card.
Organization of the session

- Welcome and introduction to Epicenter research
- A closer look at our study of entrepreneurship programs for undergraduate engineers
  - Methods
  - Findings related to program creation and growth
- Q&A with the audience
- Panel discussion with three engineers/leaders engaged in entrepreneurship program development
- Q&A with the audience

Our approach to framing Epicenter Research: Building knowledge, communities and connections

Those currently conducting research in entrepreneurship education:
- Literature Review
- May 2012 Research Workshop

Entrepreneurship education research community

- Workshops
- Conferences
- Collaborations
- Materials

Faculty, practitioners and students

Epicenter community and partners

Participants and users, collaborators

Co-framers, collaborators and users
Epicenter Research Questions

RQ1: What are current models of educating engineers for entrepreneurship/entrepreneurial thinking?

RQ2: What are undergraduate engineering students’ entrepreneurial interests, abilities, and achievements? How do these interests, abilities, and achievements change over time? Which educational and workplace environments/experiences influence the development of their entrepreneurial interests, abilities, and achievements?

RQ3: How can fundamental engineering curricula be reframed to stimulate integrative thinking, especially entrepreneurial thinking?

My Founding Story
• Mechanical engineering at Texas A&M
• Mechanical engineering at Texas A&M

• Controls research

Carolyn Estrada, USRG 2010 Poster
epicenter.stanford.edu
• What do I want to do?

• Engineering entrepreneurship education
• What do I want to do?

• Engineering entrepreneurship education

• What's next?

fitbit

RQ1 Research Methods
RQ1: What are current models of educating engineers for entrepreneurship/entrepreneurial thinking?

- Quantitative program data were collected from 18 entrepreneurship programs at 17 U.S. colleges and universities
- In-depth interviews were conducted with entrepreneurship program directors/coordinators at 12 of these 18 programs; these 12 programs compose the primary sample for analysis
- Interviews averaged about 60 minutes in length

*Drawing from Duval-Couetil, Shartrand, and Reed (forthcoming)
RQ1 interview data analysis plan

Program histories
Reasons for starting, growth and change over time

Program frameworks

Program pedagogies

Program contexts

Findings from our research
Findings from our research

Program Creation
- Various conditions support program creation
  - Impart business skills, perceived needs, leader with vision, critical do-ers, catalytic funding

Program Growth
- Student interest can drive program growth
- Ongoing and resolved “growing pains”
Various conditions support program creation

INTENT

1. Imparting business skills

PROCESS

2. Perceived needs related to entrepreneurship

3. Leader with vision

4. Critical “do-ers”

5. Catalytic funding

Conditions behind program creation
[Students] need to have some idea of what business is about if they are going to successfully compete against their peers from other schools.

Condition 1: Imparting Business Skills

Conditions behind program creation:

1. Imparting business skills
2. Perceived needs related to entrepreneurship
3. Leader with vision
4. Critical "do-ers"
5. Catalytic funding
[Engineering students] just had very few ways to learn about [entrepreneurship] … That meant that they had to go try and fight their way into a business school class, which was pretty tough.
Condition 3: Leader with Vision

That’s how we got started, because [the dean] helped to press the development officers to go get the endowment to fund the beginning of the program.

Conditions behind program creation

1. Imparting business skills
2. Perceived needs related to entrepreneurship
3. Leader with vision
4. Critical “do-ers”
5. Catalytic funding
Condition 4: Critical Do-ers from Industry

I came out of industry, having done some entrepreneurial things, and a lot of business and just commercial experience, and began to try to form an entrepreneurship certificate program in the College of Engineering.

Condition 4: Critical Do-ers from University

[The program director] got together with [business faculty] and … put together a proposal basically to introduce an … engineering entrepreneurship minor.
We started raising significant money from foundations and individuals and [two years later] was more or less officially the kick off of [our program].
Program Growth

Student interest and demand often drive program growth
Student Demand

We have many students interested in entrepreneurship, but [also] a lot of students interested in “how as an engineering major can I learn about business?”

Student Demand

It was really eye-opening for our students to start talking about things like marketing strategies in the high tech space, to talk about venture capital, to talk about all these things they hear about.
Programs reported both resolved and ongoing “growing pains”

Ongoing Growing Pains

*We’ve never done [the course] since [the original professor left]. Part of it is we’ve never found somebody who could [teach] it.*
Resolved Growing Pains

We’ve retained that pedagogical approach [for our course], even though it’s not quite as we originally formulated it.

Summary

• Not all conditions presented are needed to start a program, but we found that all programs had at least one of these factors
• Industry is a resource
• The presence (or absence) of a business school plays a role in program development
• Students play a big role in growing the program
• Growing pains are present in multiple programs, but there are solutions for these challenges
  – Leverage reality in your favor
Questions?

• Not all conditions presented are needed to start a program, but we found that all programs had at least one of these factors
• Industry is a resource
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Q&A about RQ1 findings
Panel Discussion

Guiding questions for our panelists

- How would you describe your (planned or actual) entrepreneurship program for undergraduate engineers? What are the goals for the programming you are developing or have already developed? What was the major impetus for getting things started at your campus?
- What have you learned so far about the resources and roles needed for entrepreneurship program development? What have been the essential ingredients at your campus for getting things going?
- What are you currently aiming to accomplish in the short term? What is your ultimate vision for entrepreneurship education for engineers at your campus?
Our Panelists

Aileen Y. Huang-Saad

Associate Director for Academic Programs,
Center for Entrepreneurship
Lecturer IV, Biomedical Engineering

University of Michigan

epicenter.stanford.edu

Our Panelists

Timothy L. Faley

Kiril Sokoloff Distinguished Professor of Entrepreneurship
Special Assistant to the President for Entrepreneurial Initiatives

University of the Virgin Islands

epicenter.stanford.edu
UVI Entrepreneurship

Developing the next generation of Serial Entrepreneurs and Venture Investors

www.uvi.edu

March 2014

Innovative Business Formation has 2 Parts

The Entrepreneurial Arch

- Assets (physical/intellectual)
- Know-how, Skills, Expertise
- Relationships, Networks
- Aspirations, Passions, and Interests

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Book to be published by Cambridge Press
September 2014
Objective: Robust, complimentary programs; Investment per student matches outcome

Student Skill-building Impact Framework

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<tr>
<th>Marquee Program Quadrant</th>
<th>Scalable Skill-development Programs</th>
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<tbody>
<tr>
<td>Highly visible, elite programs</td>
<td>Highly effective, scalable programs</td>
</tr>
<tr>
<td>Highly attractive to students</td>
<td>“Work-horse” programs</td>
</tr>
<tr>
<td>Least cost-effective</td>
<td>Most cost-effective to build skills</td>
</tr>
<tr>
<td>Must be able to move students that do not get into these programs to other skill-building programs</td>
<td>Goal is to drive students into programs of this quadrant</td>
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Ex: 13D B-Plan Competition  
New: Business Investment Pitch (Involve Finance Students)

<table>
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<tr>
<th>Developing Programs</th>
<th>Motivational Program Quadrant</th>
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<tbody>
<tr>
<td>Developing student skill-building programs</td>
<td>Awareness-raising and motivational programs.</td>
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<tr>
<td>Assess programs of this quadrant to move them to appropriate quadrants or eliminate them so they do not become resource distractions.</td>
<td>Low cost/student contact</td>
</tr>
<tr>
<td></td>
<td>Goal is to inspire students to move into skill-development program quadrant</td>
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Ex: UVI Entrepreneurship Club  
High School Entrepreneurship Programs

Our Panelists

E. Daniel Hirleman

Dean, School of Engineering  
University of California, Merced
Innovation and Entrepreneurship
School of Engineering, UC Merced

OPEN, March 22, 2014

The Promise

Access to UC-level research & education for the underserved (5M people in SJV, child poverty, unemployment)

Regional economic growth, diversification, good career options
National Center for Engineering Pathways to Innovation (Epicenter)

The Landscape

- Changing UC Funding Models
- Pragmatic w.r.t. to careers
- Community Engaged mindset
- Students own IP from Courses
- Stdt/Fac Ratios ~2X Tier 1
- ~2/3 1st generation Students
- ~2/3 Pell-eligible Students
- >60% from underrepresented groups
- ~10% Industry Internships (~90% Tier 1)

Innovation and Entrepreneurship

- Cornerstone - Service Learning (social Entrepreneurship)
- Co-Curricular Activities (MobileApp Challenge, UIFs, Hackathon, Maker space)
- ENGR 102 – IP for Engineers and Scientists (Term project Provisional App to USPTO)
- Capstone – Innovation & Design Clinic
- Innovate to Grow (innovation expo)
Innovation and Design Clinic

- Design, build, demonstrate project
- Innovation & tech transfer mindset
- Project Management, P/C/FDR, IP, Ethics
- Mentored & sponsored experience

Students who choose assign IP(+Patent App.)

IDC/I2G Partners/Sponsors:

- Alta Health Clinic
- Anthropocene Inst.
- Aquacue
- CA Dept. of Conserv.
- CA Dept. Water Res. (2)
- CALFIRE (2)
  - Children’s CHCC (3)
  - Center for Vision Enhance
  - D&S Farms/Atwater Pack.
  - DARPA
  - Duarte Nurseries
  - E&J Gallo (3)
  - Grundfos Pumps
- Gunderson Dettmer*
- Hilmar Cheese (2)
- Dr. V. Lakireddy (3)*
- Olam
- Phoenix Energy
- PG&E (2)
- Santa Fe Aggregates
- Southern Cal Edison (2)*
- Sunrise Growers
- Turlock Irrigation Dist. (2)
- Wells Fargo (3)
- Womble Carlyle*
- Yosemite Nat. Park (2)
Q&A with Panelists: Connecting Burning Questions to Panelists’ Stories

Epicenter Research

Thank you for coming today!

For questions about Epicenter Research, please contact Professor Sheri Sheppard, Epicenter Co-PI, at sheppard@stanford.edu
Opportunities for Future Engagement

2014 Epicenter Research Summit
Please talk to any of today’s presenters: Sheri Sheppard, Carolyn Estrada, Helen Chen (Epicenter, Stanford) and Angela Shartrand (Epicenter, NCIIA)

Epicenter Pathways Initiatives
Please talk to Liz Nilsen (Epicenter, NCIIA) for more information

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Thank you!

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