# How Seattle University **Plans to REvolutionize Engineering Education** through Industry Immersion

Yen-Lin Han, Assistant Professor Mechanical Engineering, Seattle University 10/23/2018

## REvolutionizing Engineering and Computer Science Departments (RED)

REvolutionizing engineering and computer science departments (RED) is a significant, multi-directorate program emanating from the National Science Foundation's IUSE (Improving Undergraduate STEM Education) and PFE (Professional Formation of Engineers) frameworks.

The program supports departments to create "significant sustainable changes necessary to overcome longstanding issues in their undergraduate programs and educate inclusive communities of engineering and computer science students prepared to solve 21st-century challenges."

#### **RED** Awardees



https://academicchange.org/red/

# Cohort 1 (2015 Awardees)

Institution	Department	Project Title
Arizona State University	Engineering	Additive Innovation: An Educational Ecosystem of Making & Risk Taking
Colorado State University	Electrical and Computer Engineering	Revolutionizing Roles to Reimagine Integrated Systems of Engineering Formation
Oregon State University	Chemical, Biological & Environmental Engineering	Shifting Department Culture to Re- situate Learning and Instruction
Purdue University	Mechanical Engineering	An Engineering Education Skunkworks to Spark Departmental Revolution
University of North Carolina, Charlotte	Computer Science	The Connected Learner: Design Patterns for Transforming Computing and Informatics Education
University of San Diego	School of Engineering	Developing Changemaking Engineers

# Cohort 2 (2016 Awardees)

Institution	Department	Project Title
Boise State University	Computer Science	Computer Science Professionals Hatchery
lowa State University	Electrical and Computer Engineering	Reinventing the Instructional and Departmental Enterprise to Advance the Professional Formation of Electrical and Computer Engineers
Rowan University	Civil & Environmental Engineering	Revolutionizing Engineering Diversity (RevED)
University of Illinois at Urbana- Champaign	Bioengineering	Defining the Frontiers of Bioengineering Education at Illinois & Beyond
University of New Mexico	Chemistry & Bio. Engineering	Formation of Accomplished Chemical Engineers for Transforming Society
University of Texas at El Paso	Computer Science	A Model of Change for Preparing a New Generation for Professional Practice in Computer Science
Virginia Tech	Electrical and Computer Engineering	Radically Expanding Pathways in the Professional Formation of Engineers

# Cohort 3 (2017 Awardees)

Institution	Department	Project Title
Clemson University	Civil Engineering	Clemson University: Learning Teams and Innovation Ventures for Adaptable Training in Engineering (CULTIVATE)
East Carolina University	Computer Science	PPSE - Programmers to Professional Software Engineers
Georgia Tech	Biomedical Engineering	Transforming for inclusion: fostering belonging and uniqueness in engineering education and practice
North Carolina A&T	Chemistry & Bio. Engineering	A Revolution in Engineering Education Motivated by Needs and Designs
Seattle University	Mechanical Engineering	Revolutionizing through a Focus on Identity
Texas A&M	Aerospace Engineering	REvolutionizing Diversity Of Engineering (REDO-E)

# Seattle University RED Team



## Objective

To develop a mechanical engineering program where students are immersed in a culture of doing engineering with engineers that in turn fosters an identity of being an engineer.





## **Department's Shared Vision**

#### Doing Engineering with Engineers, Fostering Engineering Identities

- The department will be a hub of engineering with engineers.
- Faculty, students, and industry will share experiences and ideas.
- An Industry Advisor will nurture ties and facilitate communication and connection with industry.

## Faculty Priorities

Maintaining Strong Connections with Industry and Incorporating Industry Practice into the Program

- Faculty will see their role or identity as guides moving students towards becoming practicing engineers.
- Faculty will use pedagogic methods that enable student engagement in activities that reflect what a practicing engineer might do.
- Faculty will acquire relevant industrial and teacher training.
- Faculty will participate in Industry Immersion Experiences.

## Curriculum

#### Interacting with Industry and Cultivating Engineering Identities

- Courses will include activities that reflect engineering practice.
- Vertically integrated design projects will connect to industry.
- Students will reflect on their education, identities, and career paths.

## Supportive Policies

#### Change Expectations in Departmental Reviews

- Faculty Performance Reviews will recognize and commend faculty's engagement with industry and curricular revision.
- Department's assessment guidelines and procedures will be revised to reflect a broader view of assessment.

### Research Questions & Assessments

- 1. How have the identities of the students and faculty changed? -
  - Explicit and implicit measures will track identity changes.
- 2. How has the departmental culture changed?
  - Interviews with faculty and students will provide a view of culture change in the program.
- 3. What happened in response to the changes that occurred?
  The path to change will be audio/video documented so that it can be shared with others in the future.

RED Rollout		Year				
		1	2	3	4	5
pa r	Obtain consensus on shared vision	x				
Share Visio	Revise department mission	x				
ح <del>ر</del> ب	Faculty industry immersion experiences		х	х	х	х
culty ustr	Faculty training and department vision day		х	х	х	х
Fac	Hire industry consultant	х	х	х	х	х
	Course development and revision	х	х	х	х	х
unlr	Offer revised curriculum			х	х	х
rricu	Makeathons, industry seminars socials		х	х	х	х
Cur	Update and use makerspace		х	х	х	х
cies	Revise annual performance review evaluations		х	х		
Polic	Revise assessment guidelines and procedures		x	x		
on	Student & facutly surveys, IATs, and interviews	х	х	х	х	х
Evaluatic & Resear	Student portfolios and reflections		х	х	х	х
	Visits by external evaluator	x	x	x	х	x
ing	Conferences and workshops	х	х	х	х	х
Shar	Visiting scholars				х	x

## Current Status - First Year Completed

- First year efforts focused on building a shared vision, faculty and industrial connections, and revising the program's curriculum.
- Baseline survey, portfolio, and interview data have been collected.
- Documentation of ongoing changes in department culture specifically among faculty is being collected.
- Results are being disseminated in conferences, workshops, and papers.





## Industry Adviser

- Strengthens the connection between the department and industry.
- Mentors students with industry-relevant experiences and career advice.
- Helps faculty identify industry immersion experiences.
- Helps faculty connect theory to practice in curriculum revision.
- Helps plan yearly Makeathons and other industry related activities.
- And more.....

### Professional Organizations- Examples

- Help identify opportunities for faculty immersion experiences in industry.
- Be committed to building connections between academia and industry to improve engineering education.
- Provide venues for dissemination.
- Provide training for faculty and/or students both during the grant period and beyond.

## ICI Members & SU

- INCAST article for SU RED Project.
- Student resume review.
- 3D Systems Seattle site visit.
- More to come!

## Significance

#### This research program will lead to

- Understanding how identities affect students' engagement, performance, and persistence.
- Changing incentives and training for faculty to promote industry engagement.
- Building strong industry-education interactions throughout the program.
- Better understanding of how best to create an inclusive educational environment.