

Ph.D. in Engineering Education Systems and Design (EESD)

Arizona State University



Ira A. Fulton
Schools of
Engineering
Arizona State
University

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

engineering.asu.edu/eesd

Institute for STEM and Diversity Initiatives

- Advocating for and nurturing underrepresented student and faculty success inside and beyond the classroom
- Conducting and catalyzing STEM educational research

IDoTeach

- Incorporating engineering in a pre-service STEM teacher education program
- Developing a streamlined engineering degree pathway to facilitate undergraduate engineering majors teaching in the K-12 classroom

Multi-disciplinary B.S. Engineering Degree (new)

NSF Funded STEM Education Projects

- WIDER, REUs, RETs, S-STEMs, IUSe:RED Site – Computer Science Professionals Hatchery

Engineering and Science Education PhD and Certificate programs



- The Clemson Department of Engineering and Science Education offers a unique experience with engineering education research and science education research in one program.
- Our learning community provides strong mentoring, colleagues passionate about their research, and engagement with projects encompassing social capital, motivation, mathematical success, retention, self-efficacy, international experiences, and sustainability education.

Contact ESEGradinquiries@Clemson.edu or LC@Clemson.edu





A new approach to engineering education scholarship – UGA's innovation-research ecosystem

- **Cross-cutting** – 50 members from 3 schools and 15 degree programs
- **Community and shared capacity** – leverages core ENED research strengths
- **Focus on people and impact** – collaboration of practitioners, innovators, and researchers
- **Interdisciplinary** – Cutting edge interdisciplinary and interprofessional approaches

EETI Leadership Team



Jo Walther



Nicki Sochacka

EETI New Faculty hires



Nathaniel Hunsu



Dominik May

The home of...



Coming soon...

- PhD in “Engineering Studies and Transformative Practice” offered through EETI

Louisiana Tech University Integrated STEM Education Research Center



Center Priorities

- **Curriculum Design & Development**
 - Hands-on, project-driven
 - Cross-disciplinary
 - Student ownership of labs
 - Apprenticeship learning
- **K-12 Teacher Professional Development**
 - Mentoring experiences
 - Cross-disciplinary, project-driven
- **Diversity and Inclusion in STEM**
- **Student Progress & Pathways**



Graduate Programs

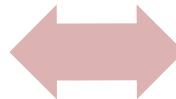
- **PhD Engineering – Engineering Education concentration**
- **PhD Computational Analysis and Modeling (CAM) – STEM Education concentration**

UNIVERSITY OF
LOUISVILLE

J.B. Speed School of Engineering @ University of Louisville



**Center for Teaching
and Learning
Engineering**



**Engineering
Education Research
Group**

Centre for Engineering Education (CEE) Universiti Teknologi Malaysia (UTM)

Activities of CEE

- Rigorous research in engineering education – grants, collaborations, publications, & PhD program
- Training on innovative T&L, and conducting research in engineering education → mentoring champions
- Host conferences, workshops, and Innovative Practices in Higher Education Expo (IPHEX)

Transforming engineering education through innovative evidence-based practices

- Focus on training and research in Engineering Education
- PhD in Engineering Education program
 - Started in 2008
 - Up till now, 13 students completed PhD
 - Current enrolment: 40 students
- Also: Joint PhD in Engineering Education with Aalborg University, Denmark
- Post-doctoral and faculty position available



Contact:

khairiyah@cheme.utm.my

<http://tree.utm.my>



CREATE for STEM Institute

create4stem.msu.edu

Mark Urban-Lurain

Associate Director, Engineering Education

urban@msu.edu

- **C**ollaborative **R**esearch in **E**ducation, **A**ssessment and **T**eaching **E**nvironments for the fields of **S**cience, **T**echnology, **E**ngineering and **M**athematics
- Goal: improve STEM teaching and learning from grades K-16 through interdisciplinary research and development
- Research Areas:
 - Creating and Investigating Change in K-16 STEM Education
 - Educational Policy in STEM fields
 - Discipline-Based Undergraduate STEM Education
 - Developing Innovative and Digital Materials
 - International Engagement with the Global STEM Education Community



New Engineering Education Research graduate program
launched at University of Michigan. **Apply now!**

Engineering Education Research faculty embedded in
traditional engineering departments.



Shanna Daly

Mechanical
Engineering



Cindy Finelli
Director

Electrical & Computer
Engineering; Education



Mark Guzdial
Joining Fall 2018

Computer Science &
Engineering



Aileen Huang-Saad

Biomedical
Engineering



Lisa Lattuca

Education; Integrative
Systems & Design



Joi Mondisa

Industrial & Operations
Engineering

Research Interests

Design & creativity

Idea generation

Returning
students

Teaching & learning

Classroom design

Innovative technology
in the classroom

Computing education
research

Learning sciences

Public policy

Engineering
entrepreneurship
education

Instructional change in
biomedical engineering

Teaching & learning

Curriculum design &
assessment

Interdisciplinarity

Mentoring &
underrepresented
populations

Resilience, grit, &
persistence





PFE:RIEF Program Fuels Expansion of Engineering Education Research at Montana State University

In 2015, two PFE:RIEF grants to MSU set in motion a series of events that has resulted in an expansive community of researchers studying engineering education. In September of 2016, the “Montana Engineering Education Research Center”, or MEERC, was approved by the MT Board of Regents.



PI: Brock LaMeres (ECE)
Award No: 1544147 (PFE:RIEF)
Title: Research Initiation - Engineering a Culture of Engagement



PI: Paul Gannon (ChemE/BioE)
Award No: 1544174 (PFE:RIEF)
Title: Research Initiation - Effectively Integrating Sustainability into Engineering

MSU Launches New Center to Conduct Engineering Education Research
www.montana.edu/meerc

In the MEERC's first year, affiliates won 4 new NSF EER grants. The MEERC now has \$3.2M of active NSF funding (8 separate EER grants).



PI: William Schell (ME)
Award No: 1664231 (PFE)
Title: The Formation of Undergraduate Engineers as Engineering Leaders



PI: Brittany Fasy (CS)
Award #: 1657553 (ITEST)
Title: Improving the Pipeline for American Indian Students Entering CS Via Storytelling



PI: Nick Lux (Education)
Award No: 1720801 (DRK12)
Title: Designing a Middle Grades Spatial Skills Curriculum



PI: Shannon Willoughby (Physics)
Award No: 1735124 (DRT)
Title: Fostering Effective Oral Communication Skills for STEM Graduate Students

Research at MSU aims to Transform Engineering Education
www.montana.edu/meerc

In July 2017 the MEERC was awarded an internal grant titled “Expanding Engineering Education Research Capacity in the MSU College of Engineering”.

The MEERC now has 20+ active affiliate faculty.

MEERC affiliates have **17 papers** at the 2018 ASEE Annual Conference.

Department of Engineering Education

Department Chair: Dr. Monica F. Cox
cox.1192@osu.edu

Associate Chair: Dr. Lisa Abrams
abrams.34@osu.edu

Design Thinking | Diversity & Inclusion | Faculty Development | Engineering Thinking | P-12 Education | Entrepreneurial Education | Learning | Research Methods | Pedagogies, Assessment, and Evaluation | Partnerships | Professional Development | Technical Communication | Teaching

UNDERGRADUATE



FIRST-YEAR ENGINEERING

- Learning engineering design, analysis, and ethics
- Developing an entrepreneurial mindset and professional skills.
- Teamwork experience
- Over 2300 students taught each semester

MULTIDISCIPLINARY CAPSTONE

- Giving students hands-on experience through direct contact with industry professionals
- 14 different engineering departments collaborating with over 20+ non-engineering majors

TECHNICAL COMMUNICATIONS

- 36+ Class sections per year
- Preparing students for interviews
- Understanding the audience and becoming a part of the collaborative process
- Real-world applications

GRADUATE PROGRAM

- Courses on pedagogical issues, research methods, and theory
- Pursuing ground-breaking research with top scholars
- Specialization ranging from Design Thinking to P-12 Education

The Leonhard Center for the Enhancement of Engineering Education

25 years of Excellence in Engineering Education

Mission

- Catalyze and support innovative teaching, learning, and assessment to ensure that Penn State delivers world-class engineering education
- Develop and disseminate innovative approaches to address challenges faced by engineering undergraduates, graduate students, staff, and faculty

Current strategic focus areas

1. Enhancing ethics education for graduate and undergraduate students
2. Evidence-based strategies to increase engagement
3. Assessment of learning environment
4. Elevating writing and presenting skills of graduate and undergraduate students



For more information:

Contact Tom Litzinger at tal2@psu.edu or visit www.engr.psu.edu/leonhardcenter



Tom Litzinger
Center Director



Michael Alley
Director, Engineering Communications



Sarah Zappe
Director, Assessment & Instructional Support



Stephanie Cutler
Assessment & Instructional Support Specialist



PennState
College of Engineering

EERC



ENGINEERING EDUCATION
RESEARCH CENTER

*A Center of the
Swanson School
of Engineering*

Mission

- Enhance the teaching and learning of engineering within the Swanson School of Engineering
- Expand engineering education research efforts at the University

Current Focus Areas

- Assessment of teaching effectiveness and student learning; and measuring learning out of the classroom
- Engaging faculty on innovative pedagogy and creative content through engineering education research practices
- Propagation of evidence based advising and mentoring practices
- Innovation/Entrepreneurship propagation
- Training the next generation STEM faculty member in evidence based teaching practices

PITT | **SWANSON**
ENGINEERING

For more information:

Contact Mary Besterfield-Sacre at mbsacre@pitt.edu or visit www.engineering.pitt.edu/eerc

Mary Besterfield-Sacre
Center Director



Renee Clark
Director of Assessment

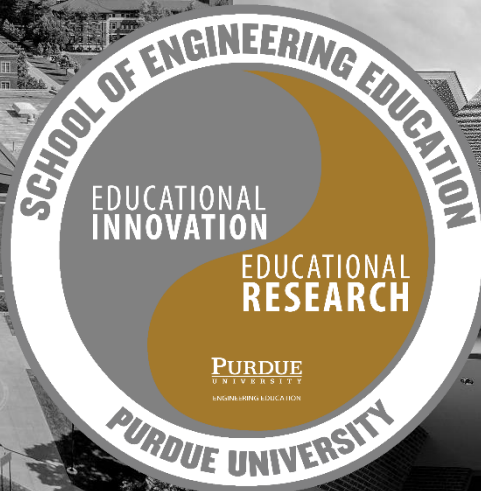
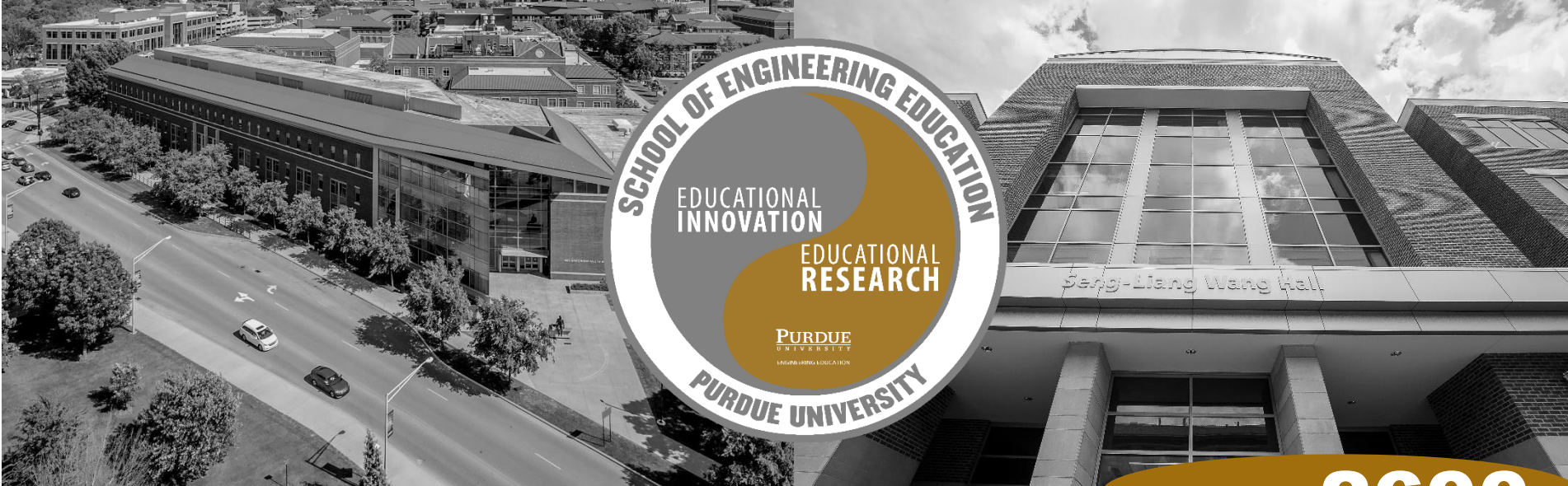


Irene Mena
*Director of Professional
Development*



April Dukes
Pitt-CIRTL Coordinator





INTEGRATING RESEARCH AND PRACTICE

PROGRAMS and OPERATIONS

- First-Year Engineering Program
- Graduate Program (MS & PhD)
- Multidisciplinary Engineering Degree Program
- INSPIRE Pre-College Engineering Research
- Student Advising
- Graduate Certificate (New 2016)
- Integrated Research Labs
- Ideas To Innovation Learning Labs

COLLABORATIONS

- Chemical Engineering
- Electrical and Computer Engineering
- Environmental and Ecological Engineering
- Materials Engineering
- Mechanical Engineering
- College of Education



22
A/P STAFF

2 ADMIN ASSISTANTS

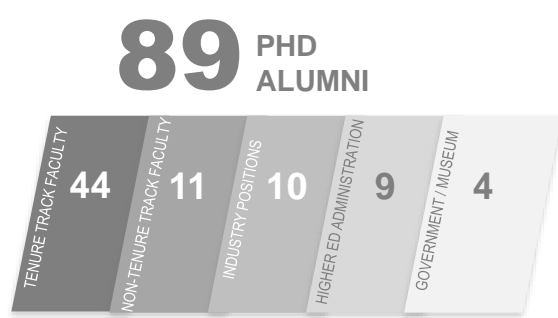
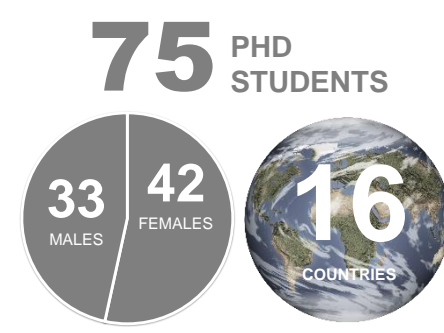
4 SECRETARIES

~2600

FIRST-YEAR ENGINEERING STUDENTS

81 MULTIDISCIPLINARY ENGINEERING STUDENTS

2017-2018 AY



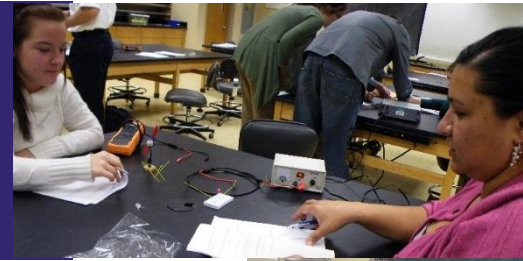
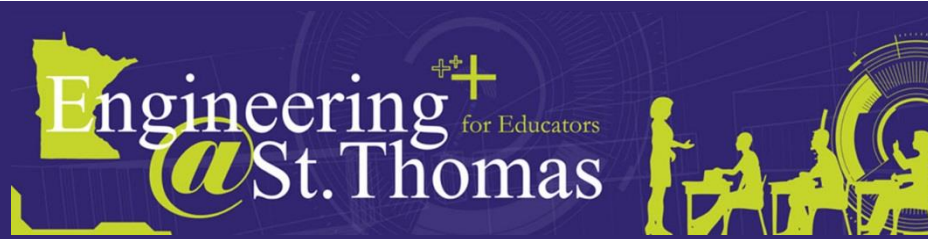


Center for the Practice and Scholarship of Education

Improving engineering education by:

- ✓ supporting faculty working to improve student learning and enhance instructional effectiveness
- ✓ assisting faculty engaged in educational scholarship and assessment
- ✓ facilitating the sharing of ideas and practices within the Institute and the larger educational community,
- ✓ promoting faculty development nationwide through the Making Academic Change Happen workshop (MACH)





The Center for Engineering Education (CEE) is a partnership between the **University of St. Thomas' Schools of Engineering and Education**

The **UST Center for Engineering Education** offers:

- a **graduate certificate** in Engineering Education
 - an **undergraduate minor** in Engineering Education
 - professional development **workshops**
-



The mission of CEE is to prepare future and current P-12 educators to teach **integrated STEM education with an engineering focus.**



<http://www.stthomas.edu/cee/>

Director: Dr. AnnMarie Thomas aphomas@stthomas.edu

The LBJ Institute for STEM Education & Research



LBJ INSTITUTE FOR
STEM EDUCATION AND RESEARCH

Leadership Team



Araceli Martinez Ortiz, Ph.D.
Executive Director



V. Sriraman, D.E.
Associate Director



Leslie Huling, Ed.D.
Senior Advisor



John Beck, Ph.D.
Senior Advisor



Laura Rodriguez Amaya, Ph.D.
Research Faculty



Stacey Bennett
Research Coordinator



Karen Fabac
Grant Specialist



Edgar Gomez
System Support Analyst



Sara Torres
Ed Research Consultant

Senior Research Fellows



Eleanor Close, Ed.D.
Research Co-Director



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 Aslambanpour, Ph.D.

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



\$15M for 5 Years/2015-2020

PI: A. Martinez Ortiz

Co-I's: L. Huling,
Aslambanpour, 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 the 3 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.



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.

\$400k for 3 Years/2015-2018

PI: A. Martinez Ortiz

Co-I: L. Rodriguez, H. Warshawer & A. Sorto

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

STEM Education

Master's & PhD Programs (97 students total)

Past and Current Research

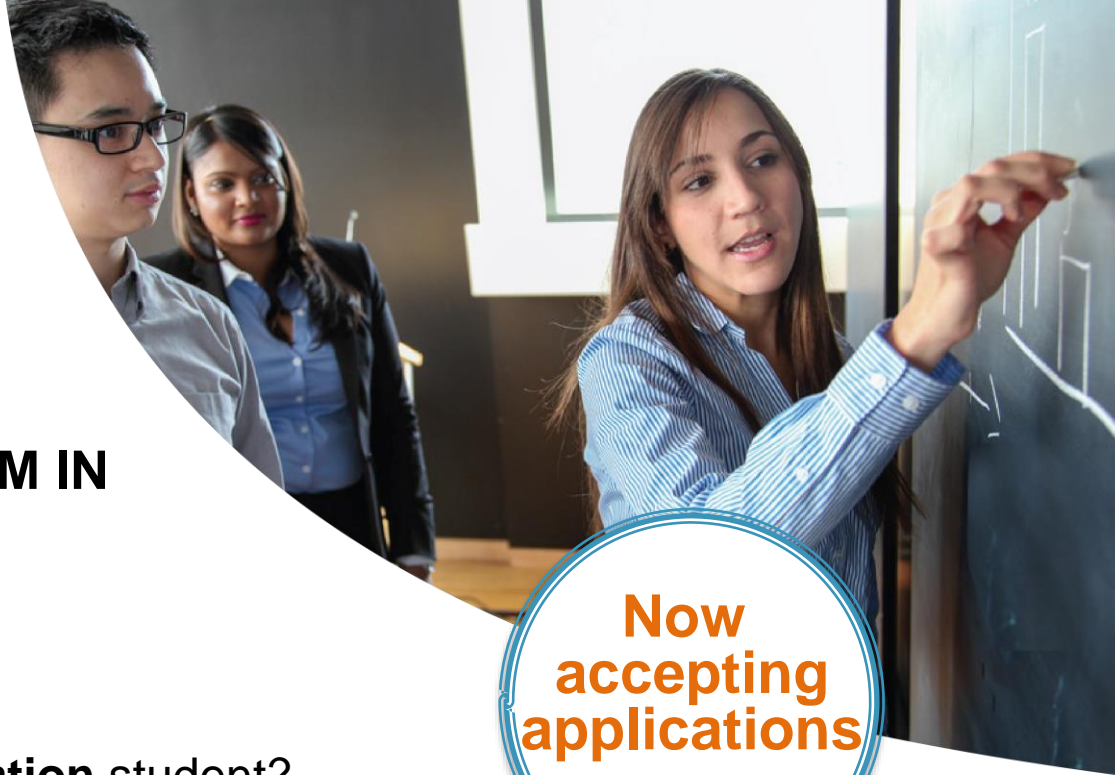
UTeach Engineering (NSF-MSP)
Beyond Blackboards (NSF-ITEST)
VaNTH (NSF-ERC)
Teacher Training for Engineering
IPRO - Programming Standing Up
Adaptive Expertise in Engineering
K-12 LEGO Robotics
Discourse in K-12 engineering teams
National HS Curriculum Project

Faculty

David Allen (Chem Eng)
Leema Berland (STEM-Ed)
Richard Crawford (Mech Eng)
Ken Diller (BioEng)
Jill Marshall (STEM-Ed)
Anthony Petrosino (STEM-Ed)
Catherine Riegler-Crumb (STEM-Ed)



UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING



COLLABORATIVE PROGRAM IN ENGINEERING EDUCATION

Are you an **engineering** or **education** student?

Want to enrich your degree with research and training in **engineering education**?

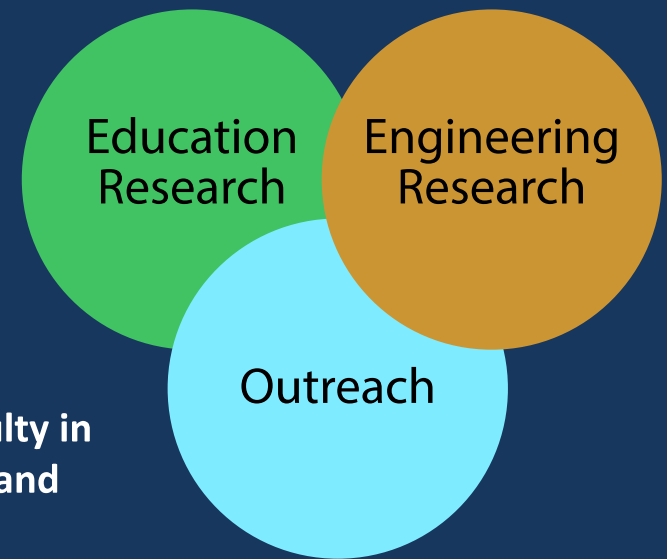
Now
accepting
applications



Offered at the **Master's and Ph.D. levels** through the ***Faculty of Applied Science & Engineering*** and the ***Ontario Institute for Studies in Education***.

Contact:

Natalie Leung, natalieyl.leung@utoronto.ca | www.gradstudies.engineering.utoronto.ca



Improving Education through Engineering



- An interdisciplinary center that includes faculty in engineering, education, child development, and computer science
- Ongoing research in engineering teaching and learning, outreach, and education technology development



- Highlighted projects:
 - Novel Engineering: Integrating Engineering and Literacy
 - TEEP: Teacher Engineering Education Program
 - ConnecTions in the Making: Elementary Students, Teachers, and STEM Professionals Integrating Science and Engineering to Design Community Solutions



- Ph.D. and M.S. in Engineering Education (in cooperation with Tufts Department of Education)

Engineering Education



Graduate Program

Graduate students in this vital and emerging field, have the opportunity to become involved in cutting-edge engineering education research, such as:

- ☐ Teaching and learning strategies
- ☐ Cognition and metacognition in engineering
- ☐ Problem solving and framing
- ☐ K-12 engineering education



About the Program

- ☐ Ph.D. Program started in **2008**
- ☐ **100%** Online Graduate Certificate in Engineering Education
- ☐ **8** Engineering Education Faculty
- ☐ **16** Ph.D. Graduate Students currently in the program

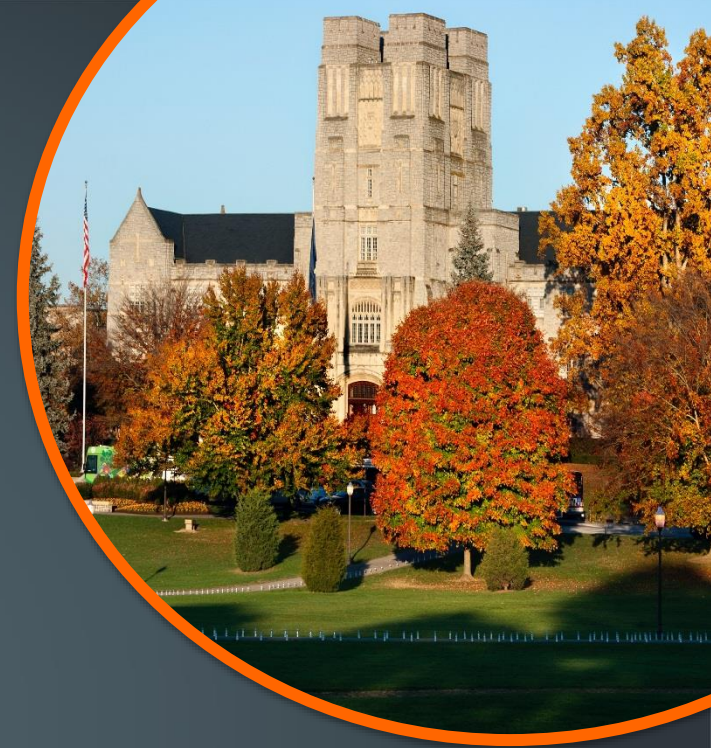
For more information: www.eed.usu.edu

Why Virginia Tech?

- Funding – We offer a competitive funding package for incoming students. Throughout the duration of the program, students easily find funding through fellowships or assistantships within or outside our Department.
- Diversity – We value diversity in backgrounds, experiences, talents, knowledge and creativity. We promote a culture of inclusivity.
- Community – The structure of our program enables direct and frequent interactions with faculty through small research groups. We encourage ideas across research groups and areas.
- Career Outlook – The character and size of our program enables optimal support to our students as they seek employment in today's job market. We have a 100 percent employment rate among all graduates.



Learn more about what a PhD in
Engineering Education
can do for you!



Find and follow us on social media!



#VTEngE

www.enge.vt.edu

Come to Booth 618 and talk with us about earning your PhD at Virginia Tech!

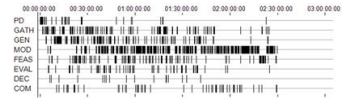
CELT Center for Engineering Learning & Teaching

CELT
CENTER FOR
ENGINEERING
LEARNING &
TEACHING



A sample of activities in the 2017-2018 academic year:

- Dancing with ambiguity
- Design “Heard” – Building on design process sonifications (<http://bit.ly/celtsoundtracks>) with an a cappella improv singing group
- Helping doctoral students learn to capably and critically read published research
- Timescales and “idea spaces” in design processes
- Using Bourdieu concepts to make visible the work of engineering education pioneers making an impact
- Engineer of 2040 “mad lib” activities
- Moved into new space in Human Centered Design & Engineering Department (come visit!)
- Supporting reflection in engineering education (see CPREE slide below)

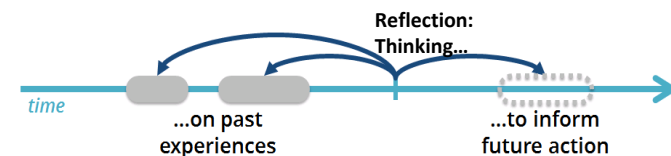


atman@uw.edu, jturns@uw.edu

W UNIVERSITY of WASHINGTON

Consortium to Promote Reflection in Engineering Education

- How we got started...
 - Gauge interest through concept papers
 - Select and orient partner campuses
 - Establish collaboration approaches
- We have done things like this...
 - Conversations with educators across the campuses to learn about how reflection is supported
 - Cataloguing 120 examples of supporting reflection in engineering education
 - Publishing of reflection field guides, <http://cpree.uw.edu/>
 - Promoting more reflection in engineering education—to date, 81,000+ student reflection experiences and 1,100+ educator experiences
- We are currently doing things like this...
 - Scholarly efforts : Additional understanding of data on activities, student perspectives, and educator perspectives; Conference papers at ASEE, REES, WEEF
 - Resource orientation: Making our “extraordinary range of seam-full data practical”
 - Workshops: (a) Two day workshop on UW campus, 50+ participants, (b) Two workshops in Malaysia (WEEF; UTM), (c) ASEE Webinar, (d) CEEA... Adapting reflection activities as a concrete and generative starting point



152

centers &
groups

68

graduate
programs

82

conferences &
workshops

66

journals

...and more

engineering education community resource

<http://bit.ly/engredu>