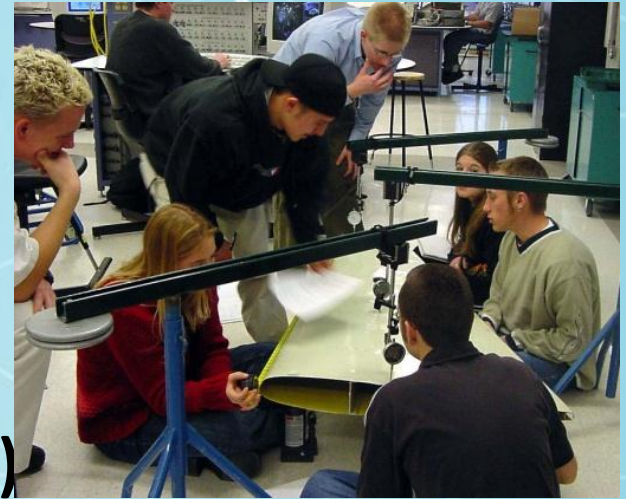


**ASEE K-12 STEM and Precollege
Activities:
What do you need to know?**

James H. Aylor, Dean, U. of Va

**Elizabeth Parry, Chair, ASEE K-12 and
Precollege Division, NCSU**

ASEE K-12 and Precollege Division



- ◆ Formed in 2005
- ◆ 742 members (12th largest in ASEE)
- ◆ 90% of members are university faculty, instructors or staff
- ◆ Majority (80%+) are discipline engineers
- ◆ 42% women (vs. 22% ASEE overall)
- ◆ In 2012, division received 176 abstracts and will present 128 papers in sessions scheduled in every time slot at the annual conference
- ◆ 20% of JEE articles published in last 4 years involved work in K-12
- ◆ Seven division members are ASEE fellows

K-12 and Precollege Strategic Areas

- **Goal is to be the center of competency for K-12 engineering research and practice**
- **Focus on development of research based professional development and curricula for K-12 students and teachers**
- **Fully participate in policy issues impacting K-12: funding priorities, standards and assessments**
- **Utilize extensive research, university and industry talent base to ensure ASEE is “at the table” on key national STEM issues**
- **Promote engineering as the context to integrate science and math with all subjects**

K-12 Engineering: Division View

- Engineering in K-12 is focused on the **process of engineering design** (“engineering the verb”)
- Foundational ideas, **based on ABET Criteria 3 on Student Outcomes**, are promoted, including:
 - ◆ *Design under constraints*
 - ◆ *Collaboration*
 - ◆ *Communication*
 - ◆ *Ethics*
 - ◆ *Failure/Improvement*
- The primary goal in K-12 is to introduce engineering design to **all students** to create a better prepared, more informed, more diverse and larger pool of students who are able to choose engineering and who are technological and engineering literate citizens



Current Division Work Efforts

- **Members represent K-12 engineering on foundation boards, STEM advocacy groups and NAE studies**
- **Leadership regularly interacts with EDC, CMC K-12 SIG, HQ and other STEM constituency groups (NSTA, ITEEA, NCTM, NAEP, NAE, etc)**
- **Chair and members working on Next Generation Science Framework and Standards review and implementation**
- **Members contributing to research base on effective K-12 engineering education and publishing results**
- **Members on state K-12 engineering standards writing teams in several states**

Current Division Work Efforts (cont)

- ◆ Executive board convening invited national meetings on K-12 engineering:
 - ✓ May 2010: Defining Engineering in Elementary Grades (Raleigh, NC)
 - ✓ June 2010: Defining the Top Research Questions in K-12 engineering (Louisville, KY)
 - ✓ June 2011: Identifying Barriers and Opportunities in K-12 Engineering (Vancouver, BC)
 - ✓ June 2012: Defining Professional Development Standards for K-12 Engineering (meeting collaboration with UTEACH, San Antonio, TX)
 - ✓ July 2012: Colloquium on P-12 Engineering Education (collaboration with STEM Center, Minneapolis, MN)
- ◆ Division leadership collaborating with Purdue INSPIRE on J-PEER journal of engineering education research

What is the value of OUTREACH to the university?

Outreach: single visits to promote engineering

- ◆ **Single visit: classroom visits (presentations and activities), mentorships in FIRST, Future City, clubs, etc.**
- ◆ **Participation increases undergraduate satisfaction, confidence and retention**
- ◆ **Creates goodwill with community**
- ◆ **Supports STEM career knowledge and development in K-12 students**
- ◆ **Increases K-12 and community knowledge of university and of engineering**
- ◆ **Attractive to industry and alumni**



What is the value of **SUSTAINED ENGAGEMENT** to the university?

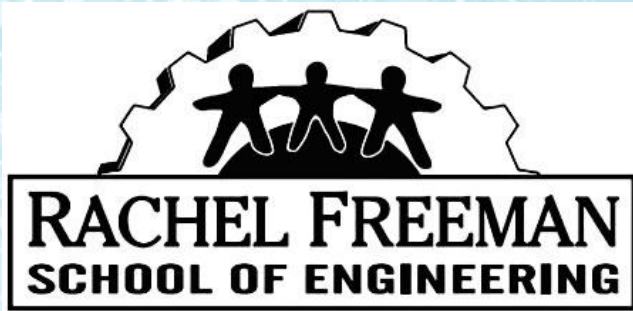
Sustained Engagement: longer partnerships to conduct research and change practice

- ◆ **Attracts a larger and more diverse cross section of university student participants**
- ◆ **Qualifies for significant research funding for university (NSF, NIH, DOD, Department of Ed, Foundations)**
- ◆ **Increases satisfaction and retention of undergraduate participants**
- ◆ **Promotes intra and inter university collaborations**
- ◆ **Addresses national priority to increase STEM pipeline**
- ◆ **Builds research base on effective teaching and learning best practices K-20**
- ◆ **Positively impacts graduate school interest and enrollment**
- ◆ **Appealing to broad and diverse cross section of faculty**
- ◆ **Attracts and increases industry and alumni support**
- ◆ **Often sustained by graduates when they start career**

The Role of Colleges of Engineering in K-12 STEM

- **Provide expertise on engineering principles**
- **Participate in K-12 standards development and refinement to support engineering literacy and pipeline**
- **Conduct rigorous research to define best practice**
- **Initiate collaborations to support short and long term goals**





Wilmington, NC

- In fifth year of engineering design focus
- Engineering is the integrator of all core subjects
- Students are 99% African American and >90% high poverty
- Long term NCSU partnership supported through NSF, Department of Education and NIH research grants
- Collaboration between College of Engineering and College of Education
- Overall student proficiency (Math, Language arts and Science) has increased from 19% to 69%
- Model has been implemented in 5 other NC schools and in six additional states
- District is implementing engineering based middle and high schools now



What can Deans do in the short term?

- ◆ **Join the K-12 and Precollege Division**
- ◆ **Promote the Division to faculty and staff**
- ◆ **Support outreach efforts**
- ◆ **Encourage substantive involvement of K-12 experts on your campus in research grants**
- ◆ **Initiate dialogue with Colleges of Education**
- ◆ **Demonstrate that effort by faculty and students in K-12 STEM is valued; P&T consideration, etc.**

What can Deans do in the long term?

- ◆ Encourage research grant submission for sustained engagement involvement
- ◆ Seek meaningful collaboration with Colleges of Education
- ◆ Promote K-12 STEM efforts to foundations and alumni
- ◆ Recognize the value of contributions to engineering education by faculty, staff and students working in K-12 STEM
- ◆ Establish an effective model for K-12 outreach and sustained engagement on your campus
- ◆ Facilitate the participation of key campus personnel in national efforts on K-12 STEM