

UTeach*Engineering and CACHE*



*Preparing Secondary Teachers
to Deliver Design-Based
Engineering Courses with
Chemical Engineering Content*

Engineering Education Nationally

- ❑ Each year there are now more high school students enrolled in year-long (+) engineering programs in high schools than there are B.S. engineering graduates in the United States
- ❑ Great degree of heterogeneity among approaches to delivering K-12 engineering, summarized in recent NRC report
- ❑ High school engineering programs will transform engineering education

State of Texas Initiatives (4x4)

- ❑ 4 x 4 Math and Science Requirement
- ❑ Greater emphasis in the STEM (science, technology, engineering, mathematics) disciplines
- ❑ One of the fourth year science courses is a year long course in engineering

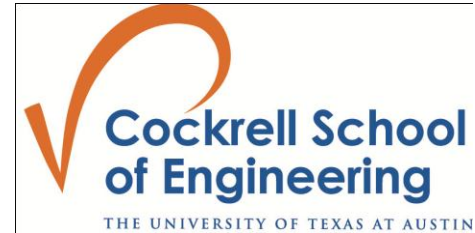
Engineering Education in Texas

- ❑ Texas has taken a lead with the “4 x 4” requirement
- ❑ Engineering as a fourth-year science course
 - 270,000 students in grade 12
 - 18 approved fourth-year courses (including engineering)
 - 15,000 students per year in Texas engineering courses
- ❑ How do we develop teacher leaders (in both the long term and short term) and curricula to support the emerging field of secondary engineering education?

A Unique Partnership



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UTeachEngineering

Preparing Secondary School Teachers to Deliver Design-Based Engineering Courses

UTeach*Engineering*'s First 5 Years

- ❑ \$12.5 million partnership grant from NSF
- ❑ A model high school engineering curriculum
- ❑ 650 teachers across Texas and beyond
 - 570 current science and math teachers prepared to teach high school engineering
 - 80 new teachers prepared to teach STEM
- ❑ A model for preparing secondary engineering educators

High School Curriculum



Overview of Year: Fall Semester

- ❑ First 6 Weeks: Energy
 - Wind turbine design challenge
- ❑ Second 6 Weeks: Reverse Engineering
 - Customer Needs
 - Design Parametrics
 - Product Redesign
- ❑ Third 6 Weeks: Robotics

Overview of Year: Spring Semester

- ❑ Three Week Design Challenge
- ❑ Twelve Week Open-ended Design Challenge:
 - Teaching the Design Process
 - ❑ Problem Identification
 - ❑ Concept Generation
 - ❑ Embodiment Design
 - Application
 - ❑ Design Scale and Full Scale Models of an emergency shelter and solar power system
 - ❑ Project can include solar tracking and/or solar concentrating, energy storage, shelter material selection, and other components, and will be evaluated based on cost and performance

Development Process

- ❑ Goal: Develop a low-cost, year-long, design-based high school engineering science course to be piloted in 2010-2011
- ❑ Monthly development meetings from September through May comprised of teachers and administrators from Austin ISD and UTeach*Engineering* project team
- ❑ Developed core teams to focus on specific 6 week units

Development Process, Con't

- ❑ Iterative process; reviewed by many groups
- ❑ Piloted in 7 schools beginning Fall 2010
- ❑ Affords us the opportunity to gather data and revise before additional implementation

Preparing Teachers

- Undergraduate Program
 - How do we prepare new teachers to deliver secondary engineering courses?
- Professional Development (Summer Institutes and MA programs)
 - How do we prepare current teachers to deliver secondary engineering courses?
- New engineering courses required

New Engineering Courses

- ❑ Graduate courses for in-service teachers seeking MA in Science and Engineering Education
- ❑ Undergraduate courses for natural science (physics, chemistry) and mathematics undergraduates preparing to become science, math and engineering teachers
- ❑ Degree pathways for engineering students preparing to become science, math and engineering teachers
- ❑ Prototypes for all of these courses are being offered at the University of Texas

UTeach*Engineering and CACHE*



*Preparing Modules with Chemical
Engineering content for High School
Engineering Courses and University-
based Courses*

U Teach *Engineering and CACHE*

- ❑ *CACHE Program is just emerging; suggestions welcome;*
- ❑ *Possible model for activities*
 - *Teacher MA projects*
 - *Modules for courses*
 - *Broader impacts activities for federally funded projects*

Questions and Discussion

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