# STEM Education: What Role Should Schools of Engineering and Technology Play?

Dean's Industrial Advisory Meeting
Thursday, June 10, 2010

Calls to action

- US National Academy of Engineering Studies:
  - The Engineer of 2020: Visions of Engineering in the New Century
  - Educating the Engineer of 2020: Adapting Engineering Education to the New Century
  - Rising Above the Gathering Storm
- Innovate America
- Europe: EU Lisbon Strategy
- China: Five Year Plan's focus on innovation
- Peru: Science, Technology & Innovation
- ?????
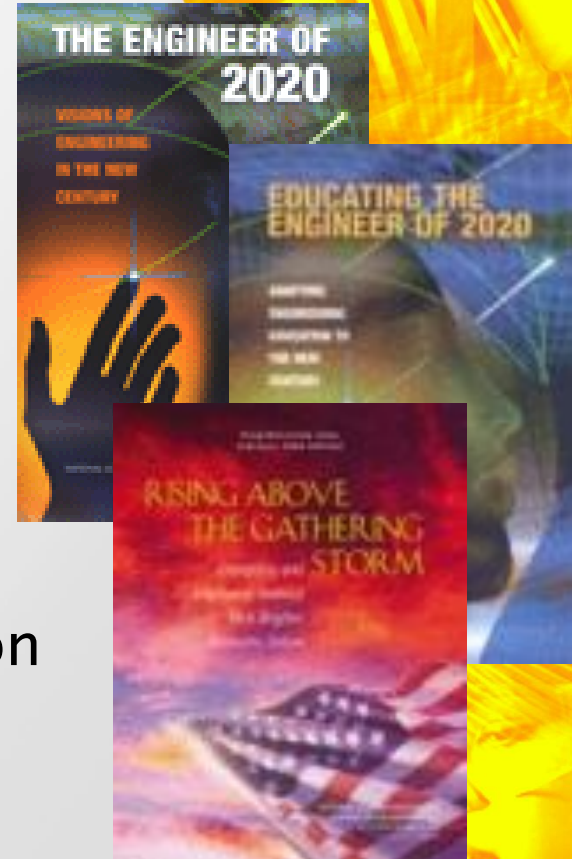
The Engineer of 2020

- ▸ Technological Context
  - ◦ Breakthrough technologies: biotechnology, nanotechnology, materials science and photonics, information and communications technology, information explosion, logistics
  - ◦ Technological challenges: urban physical infrastructure, information and communications infrastructure, environment, technology for an aging population

  Accelerating rate of technological change, interdisciplinary solutions, understanding complexity, systems perspective
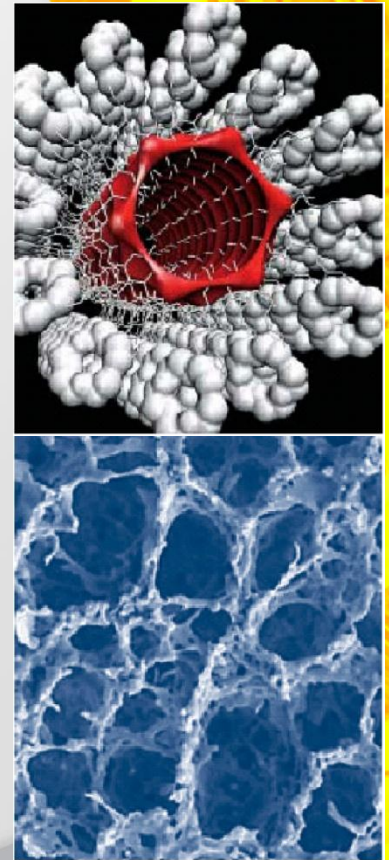
The Engineer of 2020

▶ Societal, Global, Professional Contexts
  ◦ Population: By 2020, 8 billion people, mostly in urban centers; changing workforce demographics
  ◦ Accelerating global economy
  ◦ "Customerization": made-to-order products & environments
  ◦ Health and healthcare delivery
  ◦ Security
  ◦ Increasing convergence of engineering and public policy
  ◦ Public understanding of engineering

  Positions engineering in a broad global, societal context

Attributes of NAE's *Engineer of 2020*

- Analytical skills
- Practical ingenuity
- Creativity
- Communication & teamwork skills
- Business & management skills
- High ethical standards
- Professionalism
- Leadership, including bridging public policy and technology
- Dynamism/agility/resilience/flexibility
- Lifelong learners
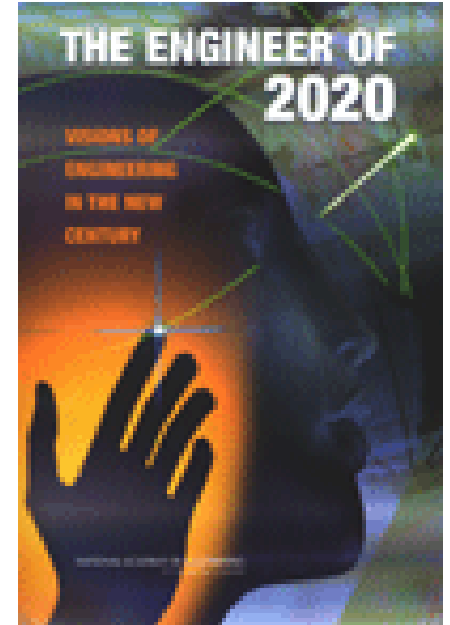
Attributes for the 21st century

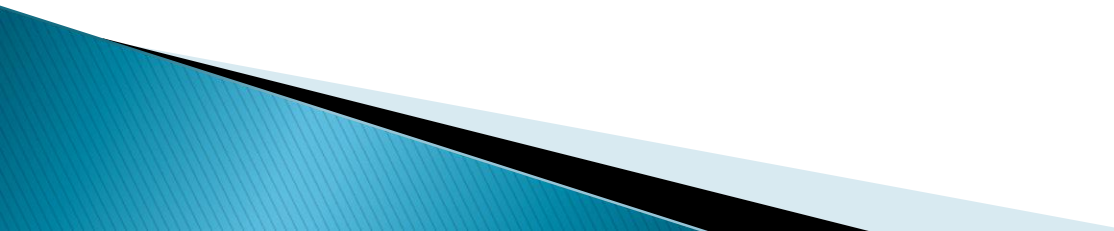| Abilities	Knowledge Areas	Traits
• *leadership*	• science & math	• *innovative*
• teamwork	• engineering fundamentals	• *strong work ethic*
• communication	• analytical skills	• ethically responsible in a global, social, intellectual, & technological context
• *decision-making*	• open-ended design & problem solving skills	• *adaptable in a changing environment*
• *recognize & manage change*	• multidisciplinarity within and beyond engineering	• *entrepreneurial and intrapreneurial*
• *work effectively in diverse & multicultural environments*	• integration of analytical, problem solving, & design skills	• curious and persistent continuous learners
• work effectively in the global engineering profession		
• synthesize engineering, business, and societal perspectives		

Key:
ABET a-k
Beyond ABET

What is the Problem?
(Sounds Like All is Well in Engineering Education)

- Women & minority students conspicuously under-represented in engineering and technology

- Public perception of engineers/ engineering/ technology is largely misinformed
  - Resulting in early decisions that block the path of children to Engineering

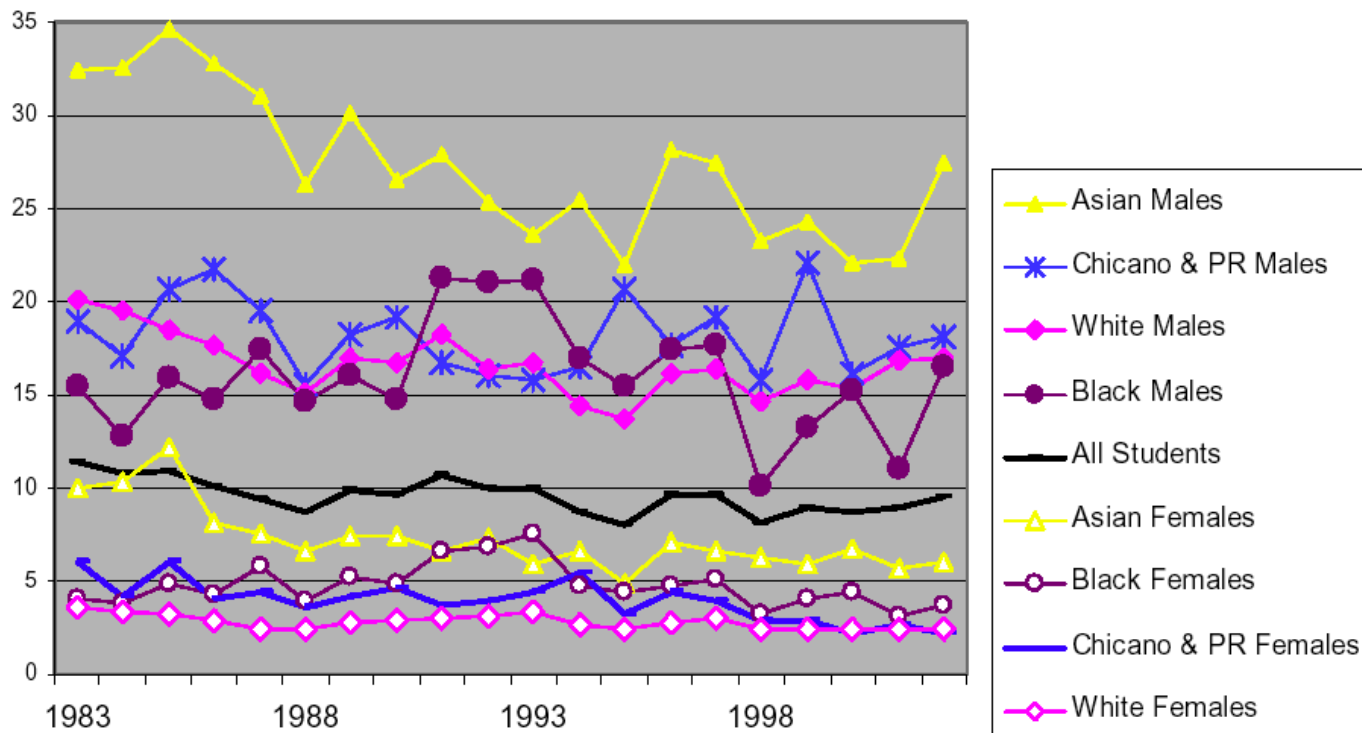# Rising Above the Gathering Storm
(National Academies of Engineering)

"Education in science, mathematics, and technology has become a focus of intense concern within the business and academic communities. The domestic and world economies depend more and more on science and engineering. But our primary and secondary schools do not seem able to produce enough students with the interest, motivation, knowledge, and skills they will need to compete and prosper in such a world."
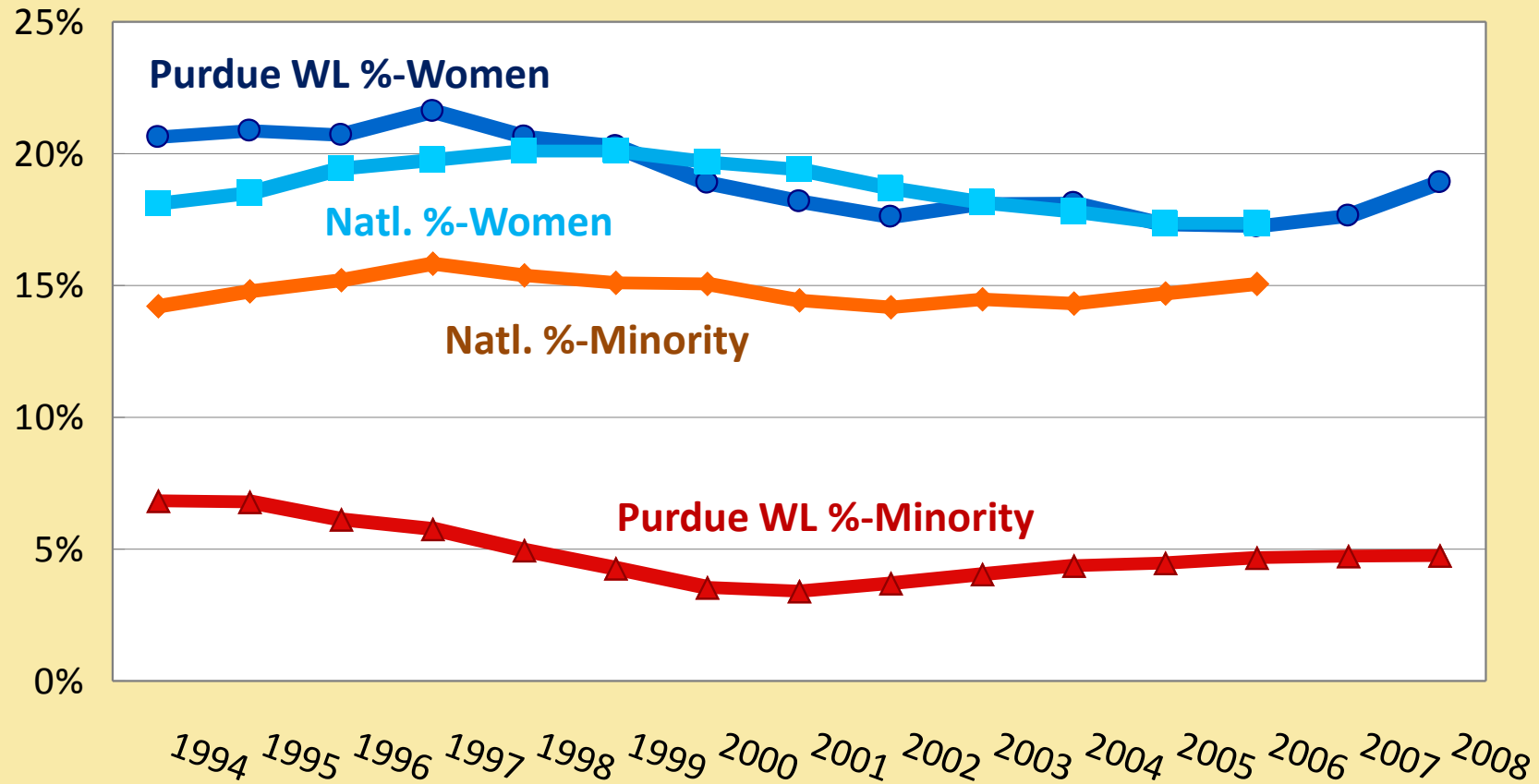
National trends: freshmen

Pct of Freshmen in Population Groups Defined by Sex, Race, & Ethnicity
Intending to Major in Engineering
[Source: HERI data in Appendix Table 2-6, NSB *Science & Engineering Indicators, 2004*]

Legend:
- Asian Males
- Chicano & PR Males
- White Males
- Black Males
- All Students
- Asian Females
- Black Females
- Chicano & PR Females
- White Females

National and Purdue: Total Enrolled Undergraduate Women and Underrepresented Minorities (URM)

Sources: Purdue Enrollment Management, Engineering Workforce Commission, Commission on Professionals in Science and Technology

BS Degrees Awarded (US)
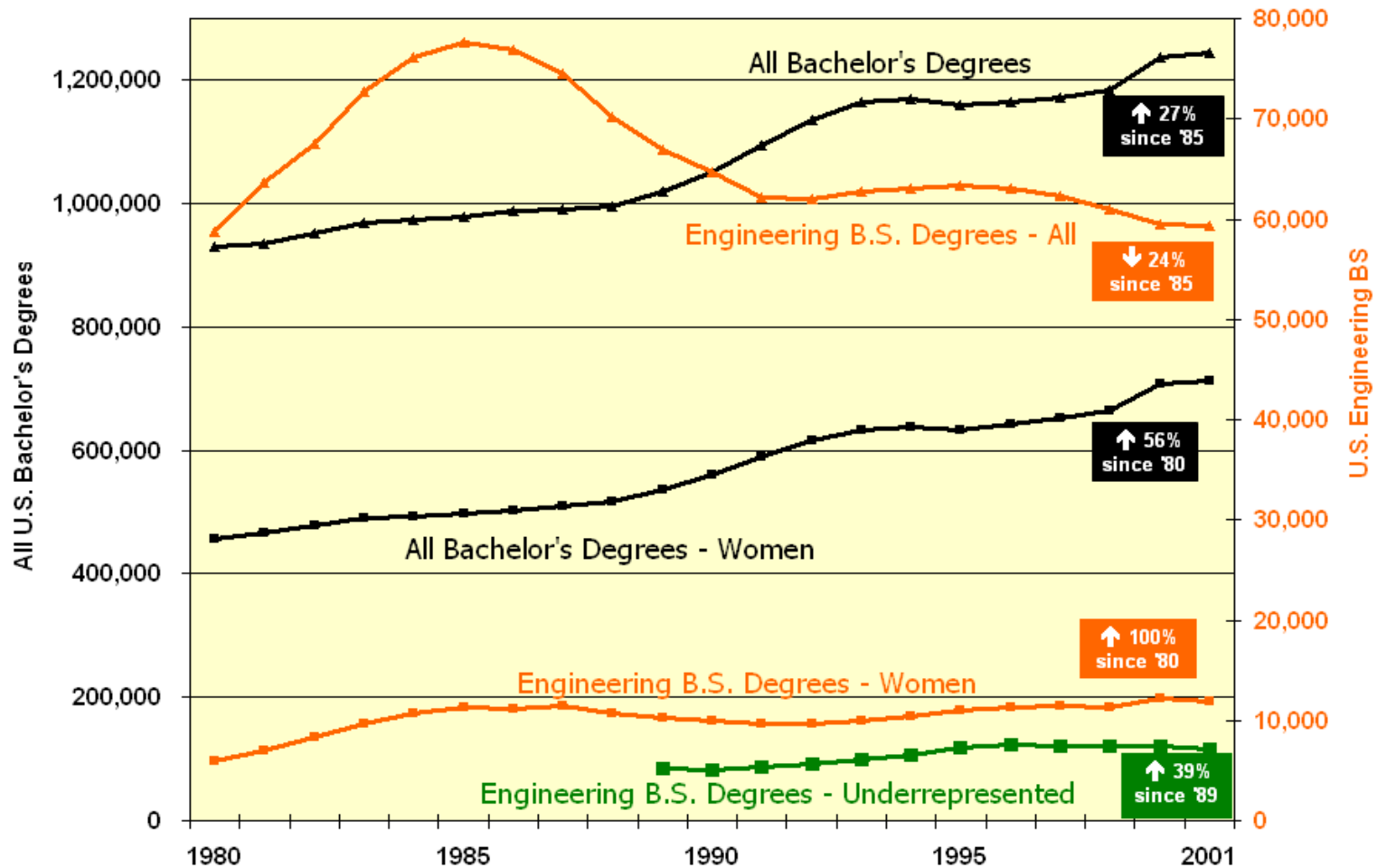
From Collegeboard.com: Law

It helps to be…	Are you ready to…
fascinated by the relationship between law and society	engage in intense discussion of thorny legal problems ?

From Collegeboard.com: Broadcast Journalism

It helps to be…	Are you ready to…
sharp of mind and quick of tongue	learn how to find and interview sources?

Bernard Shaw
Los Angeles
CNN LIVE

From Collegeboard.com:
Civil Engineering

It helps to be…	Are you ready to…
A problem-solver who's creative, curious, logical, and a fan of math.	Spend hours and hours working on problem sets and design projects?

From Collegeboard.com:
Mechanical Engineering

| It helps to be…	Are you ready to…
A fan of science and math, a creative problem solver, and someone who likes to take things apart to find out how they work.	Rely on your math skills? Master difficult scientific concepts? Take on a heavy course load? Spend five years as an undergrad…

What is the problem?

- Schools of Engineering and Technology Must Get Involved With Teacher Education
- State educational standards
- Teaching math and science using "engineering concepts"
  - … and what are engineering concepts anyway?

- Hands-on, design, problem solving & imagination!
  - Example:
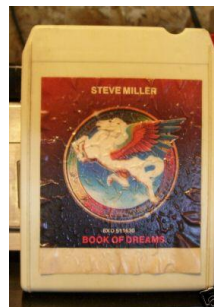
The Woodrow Wilson Indiana Teaching Fellowship

The Woodrow Wilson National Fellowship Foundation has selected IUPUI as one of four universities in Indiana to offer the Woodrow Wilson Indiana Teaching Fellowship. This initiative funded by a $10 million grant from the Lilly Endowment and administered by the Woodrow Wilson Foundation is designed to increase the number of STEM (science, technology, engineering, and mathematics) teachers in high-need Indiana schools.

Stipends

•Support provided to 80 selected fellows (20 at each university) each year with a stipend of $30,000.

•Offered to either recent college graduates or career changers who possess a degree in science, technology, engineering, and/or mathematics.

•Each Fellow who accepts the $30,000 stipend and completes the program must commit to teach mathematics, science and/or engineering technology education for three years in a high-need Indiana secondary school.

THE WOODROW WILSON
Indiana Teaching Fellowship

For more information contact:

Dr. Charles Feldhaus
cfeldhau@iupui.edu or (317) 278-1863

Fellows may select one of the three Master of Science degree options :

Master of Science in Secondary Education-Science Education
Master of Science in Mathematics-Math Education
Master of Science in Technology-STEM Education

What is Transition to Teaching? (T2T)

- Fastest route to a grade 5-12 teaching license for those who have a bachelor´s degree in Engineering or Engineering Technology

- 12-month program comprised of 18 graduate credit hours.

- This program requires a full time commitment during the fall and spring semesters.
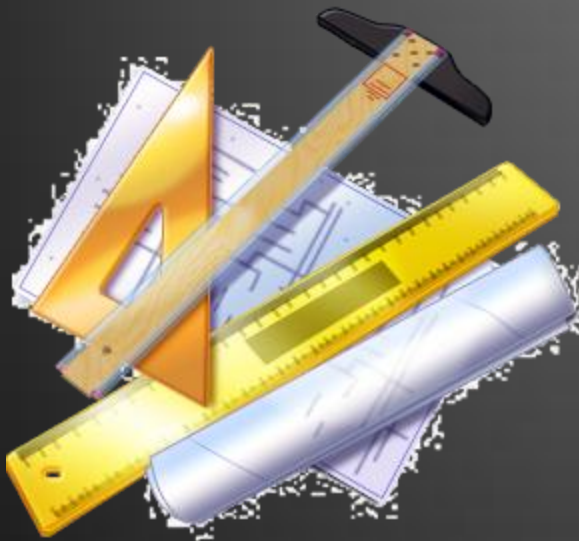
Why would I teach?

- Tough Job Market

- About 5,000 technology education teachers will be needed nationally this year
- Indiana will require more than 50 technology education teachers this year
- The starting salary range is $35,000–$40,000K for 185 days of work

# What does a technology/computer teacher do?

- ????????????

- Allow students to unravel technological problems using a hands-on, trial and error approach and project based learning
- Assist students in connecting math, science and technological principles to everyday life
- Teach design, manufacturing, power and energy, communication or transportation systems to develop technological solutions

Am I eligible?

Do you have a B.S. in:
- Aeronautical/Aviation Technology
- Architecture
- Computer Graphics Technology
- Computer Information Technology
- Computer Integrated Manufacturing Technology
- Construction/ Construction Management Technology
- Electrical Engineering Technology
- **Engineering (any discipline)**
- Engineering Technology
- Industrial Design Technology
- Industrial Technology
- Interior Design Technology
- Manufacturing Technology
- Mechanical Engineering Technology
- Technical Graphics
- Organizational Leadership and Supervision (with a 2 year Associate of Science degree in any of the above areas)
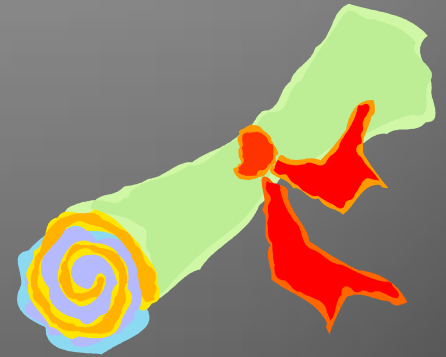
Am I eligible?

- GPA of 2.9/4.0

- Passing scores on Praxis I for admission

- Standardized Tests

What is the commitment?

- Summer II– two nights a week
- Fall–Full time at middle school, 1-2 evening classes
- Spring–Full time at high school, 1-2 evening classes
- Summer I–two nights a week
- Pass Praxis II

Required T2T Courses

Summer II : Learning as Inquiry
- P510 –Psychology in Teaching (3 cr.)

Fall Semester : Middle School
- EDUC S555 –Diversity and the Communities of All Learners (3 cr.)
- EDUC S505 –The Junior High and Middle School (3 cr.)
- EDUC M500 – Field Experience in Middle School (0cr.)

Spring Semester : High School
- EDUC S503 –Secondary School Curriculum (3 cr.)
- EDUC M500 – Field Experience in High School (0 cr.)
- TECH 56200 –Teaching Engineering Technology Content and Laboratories (3 cr.)

Summer I: Reflective Practitioner
- EDUC S590 –Independent Study, Portfolio Development (3 cr.)
- EDUC M500 –Integrated Professional Seminar (0 cr.)

Additional Recommended Courses

- **Computer Education License:**
  CIT 56500 –Teaching Computer Programming, Applications, Communication, and Design (3 cr.)

- **Project Lead the Way Certification:**
  TECH 58100—Project Lead The Way: Introduction to Engineering Design (3 cr.)

M.S. in Technology

- All 18 hours will transfer to the 33 hour M.S. in Technology program
- The salary is thousands of dollars more for teacher with a M.S.

FAQ's

▶ How much does the program cost?
  ◦ The Secondary program will cost about $9,000 in-state tuition. (2008-2009 costs)

▶ Is T2T available part time?
  ◦ No. T2T is only offered as a full time program.

Need more information?

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