

# Introduction to Engineering Education

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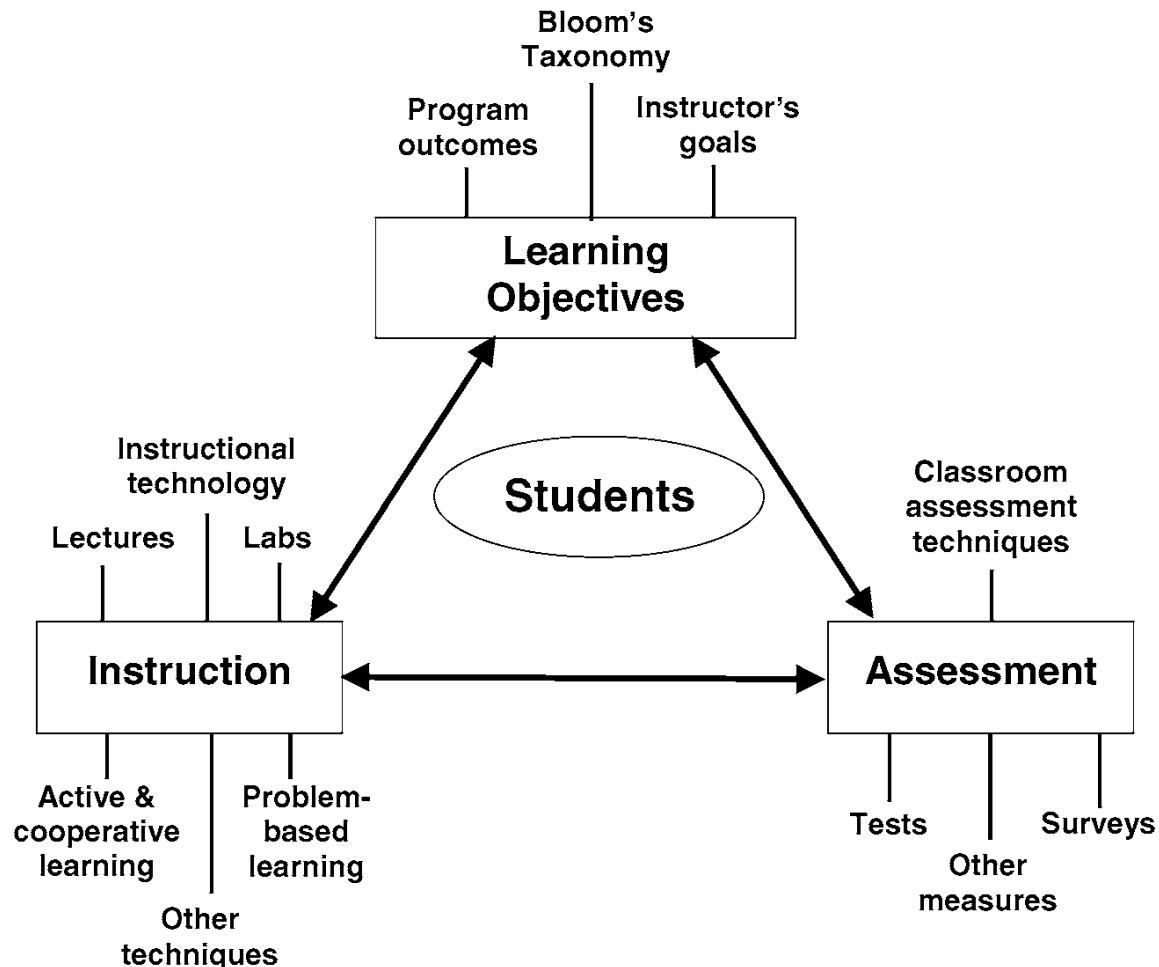


Define "engineering"

# Engineering Education

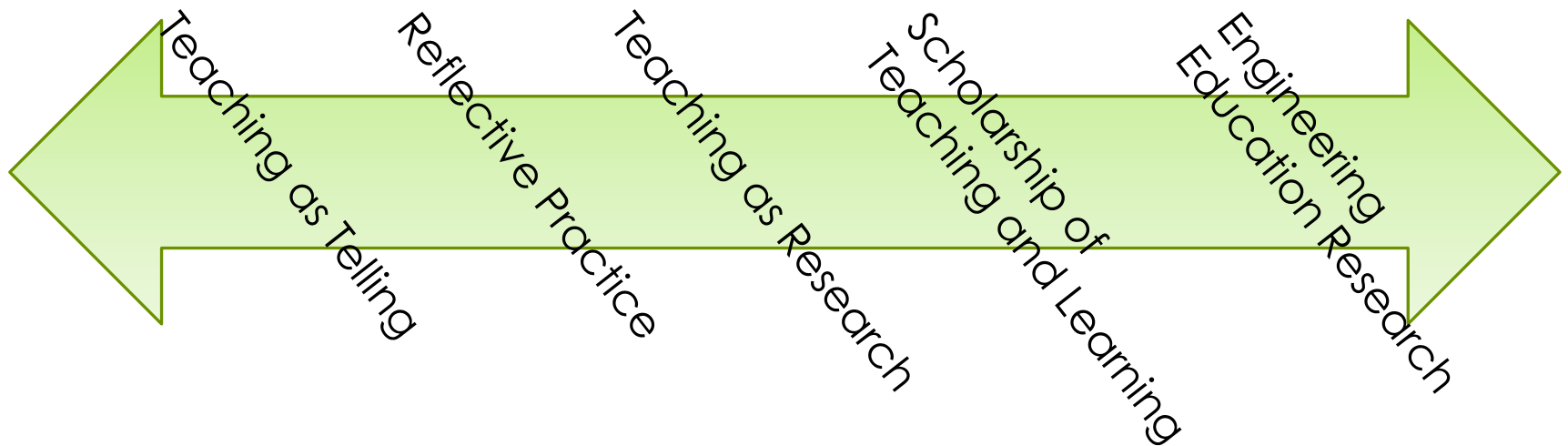
- Applying scientific principles about learning within design constraints to produce desired learning outcomes

# Elements of Course Design

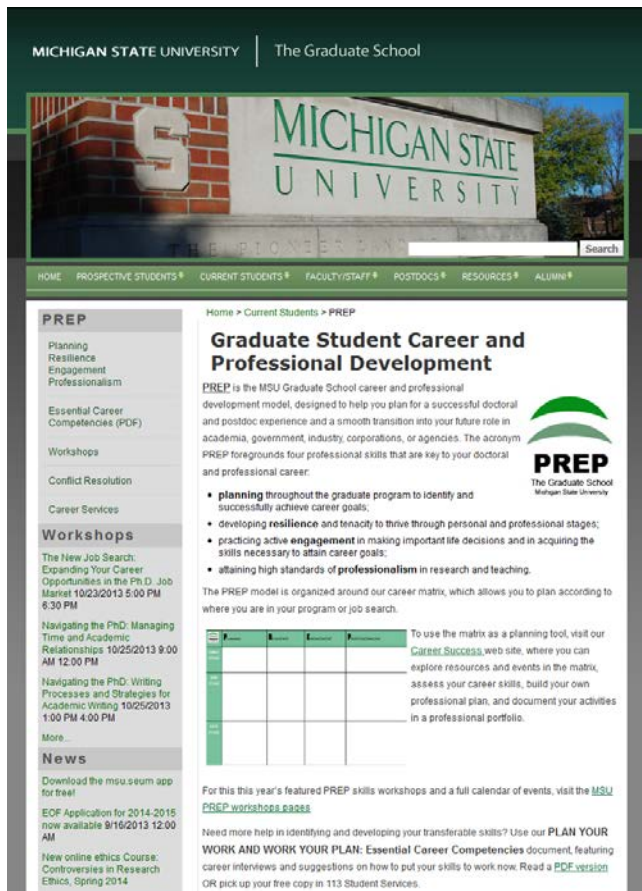


Felder, R. M., & Brent, R. (2003). Designing and teaching courses to satisfy the ABET engineering criteria. *Journal of Engineering Education*, 92(1), 7-25.

# Engineering Education: A Continuum



# Resources for Graduate Students at MSU



MICHIGAN STATE UNIVERSITY | The Graduate School

HOME PROSPECTIVE STUDENTS\* CURRENT STUDENTS\* FACULTY/STAFF\* POSTDOCS\* RESOURCES\* ALUMNI\*

## PREP

Planning  
Resilience  
Engagement  
Professionalism

Essential Career Competencies (PDF)

Workshops

Conflict Resolution

Career Services

### Workshops

The New Job Search: Expanding Your Career Opportunities in the Ph.D. Job Market 10/23/2013 5:00 PM 6:30 PM

Navigating the Ph.D. Managing Time and Academic Relationships 10/25/2013 9:00 AM 12:00 PM

Navigating the Ph.D. Writing Processes and Strategies for Academic Writing 10/25/2013 1:00 PM 4:00 PM

More...

### News

Download the msu.seum app for free!

EOF Application for 2014-2015 now available 9/16/2013 12:00 AM

New online ethics Course: Controversies in Research Ethics, Spring 2014

Home > Current Students > PREP

## Graduate Student Career and Professional Development

PREP is the MSU Graduate School career and professional development model, designed to help you plan for a successful doctoral and postdoc experience and a smooth transition into your future role in academia, government, industry, corporations, or agencies. The acronym PREP foregrounds four professional skills that are key to your doctoral and professional career:

- **planning** throughout the graduate program to identify and successfully achieve career goals;
- developing **resilience** and tenacity to thrive through personal and professional stages;
- practicing active **engagement** in making important life decisions and in acquiring the skills necessary to attain career goals;
- attaining high standards of **professionalism** in research and teaching.

The PREP model is organized around our career matrix, which allows you to plan according to where you are in your program or job search.

To use the matrix as a planning tool, visit our [Career Success](#) web site, where you can explore resources and events in the matrix, assess your career skills, build your own professional plan, and document your activities in a professional portfolio.

| Year            | 1st Year | 2nd Year | 3rd Year | Postdoc |
|-----------------|----------|----------|----------|---------|
| Planning        |          |          |          |         |
| Resilience      |          |          |          |         |
| Engagement      |          |          |          |         |
| Professionalism |          |          |          |         |

For this this year's featured PREP skills workshops and a full calendar of events, visit the [MSU PREP workshop pages](#).

Need more help in identifying and developing your transferable skills? Use our **PLAN YOUR WORK AND WORK YOUR PLAN: Essential Career Competencies** document, featuring career interviews and suggestions on how to put your skills to work now. Read a [PDF version](#) OR pick up your free copy in 113 Student Services.

- PREP
  - Planning
  - Resilience
  - Engagement
  - Professionalism
- Aligned to early, middle and late graduate program
- Range of activities from low- to high-engagement

# Range of Activities to Consider

- Low engagement
  - Individual workshops
  - Online modules (Epigeum)
  - CIRTl Coffee Hour Series ([www.cirtl.net](http://www.cirtl.net))
- Medium engagement
  - Online courses
  - EGR 811
- High engagement
  - Certification of College Teaching
  - Future Academic Scholars in Teaching (FAST Fellowship)



EGR 811

Foundations of Engineering  
Education



# Foundations of Engineering Education: Goals

- Provide foundation for Engineering graduate students interested in faculty careers
- Introduce theoretical foundations of engineering education, student learning theories, educational research, and instructional design
- Learn how to effectively teach (using various methodologies and technologies), manage, and assess student performance

# Course Structure

- Restricted to graduate students in College of Engineering
  - No other prerequisites
  - Not required for any degree program
  - Meets requirements toward MSU Certification in College Teaching program
- 3 credit, 1 semester graduate seminar
- Tuesday/Thursday, 80 minutes face-to-face
- Online discussion forums

# Objectives: Students will

- Design instructional methods that facilitate student learning and engagement
- Develop and implement course learning objectives
- Develop and apply effective course assessments
- Identify, describe and demonstrate pedagogical techniques applicable to engineering and applied science
- Demonstrate competence in selected pedagogical methods that promote effective teaching and student learning in diverse environments
- Develop classroom strategies that address accreditation, academic policy, and other external requirements

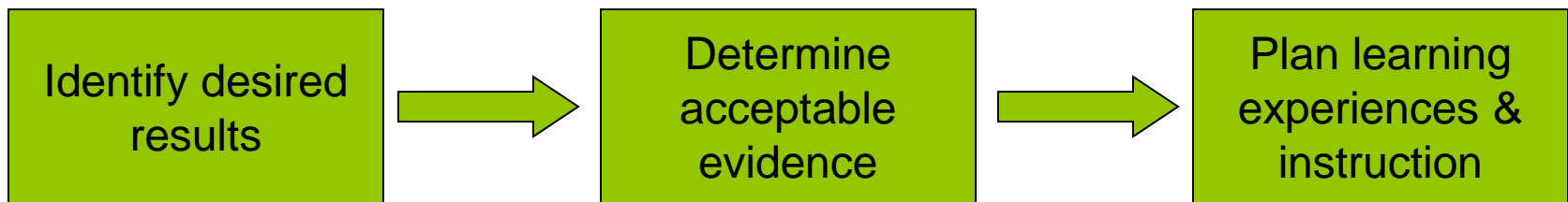
# Theoretical Framework

- Research on learning
  - How People Learn
- Constructivist
  - Learners construct knowledge by connecting new ideas to their existing knowledge
  - Existing student knowledge may be correct or consist of a mix of misconceptions and correct ideas
- Instructional challenges in engineering
  - Breadth (engineering content) vs. depth (required for meaningful learning)

# Key Design Features

- Focus on theoretic underpinnings of learning
  - NOT a list of “teaching tricks and techniques”
- Mix of majors helps students see common learning issues across disciplines rather than focus on particular topics
- Build on students’ experiences in the classroom
  - Analyze their own learning experiences in light of the learning literature
- Give students opportunities to create concrete products (instructional designs, assessments) to connect theory to practice.
  - Build on their disciplinary expertise
- Spiral curriculum
  - Rethink, revisit and revise their project designs

# Course Framework: Backward Design



Wiggins, G., & McTighe, J. (1998). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development.

# Learning Activities

- Assigned readings with online discussions prior to class
  - Classroom discussion of readings
- Iterative development of instructional design project (SoTL)
- Peer reviewing

# Materials

- *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*
  - Committee on Developments in the Science of Learning with additional material from the Committee on Learning Research and Educational Practice, National Research Council. Publisher: National Academies Press; 2 edition (September 15, 2000); ISBN-10: 0309070368; ISBN-13: 978-0309070362
- *Understanding by Design, Expanded 2nd Edition*
  - Grant Wiggins & Jay McTighe. Publisher: Prentice Hall; Expanded 2nd edition (July 24, 2005). ISBN-10: 0131950843, ISBN-13: 978-0131950849
- *Classroom Assessment Techniques: A Handbook for College Teachers*
  - Thomas A. Angelo & K. Patricia Cross. Publisher: Jossey-Bass; 2 edition (March 12, 1993), ISBN-10: 1555425003, ISBN-13: 978-1555425005
- *Journal of Engineering Education*
  - Selected articles from JEE
- Other journal and conference papers



# Grading

- Reading Reflections Online (15%)
- Scholarship of Teaching and Learning (SoTL) Project (45%)
- Teaching Philosophy (10%)
- Leading class discussion and class participation (20%)
- Peer Reviews (10%)

# What Students Like

- The student-presented papers. I think it really fit what I was looking for in the class and led to good class discussions.
- I really liked that it had a very useful take-home end product. I know I can use my teaching portfolio and everything in it, with the comments implemented, to actually find a job.
- The classroom structure. In a circle and discussion based. I did enjoy the opportunity to lead a discussion.
- It has completely changed my perspective on teaching and what it entails to be a good educator. Student learning first!
- Lots of time for discussion and personal observations. This worked very well because, unlike me, several students had lots of teaching / TAing experience and I got a little peek into their world and got to digest some of their triumphs and tribulations because they brought them to the discussion. That was VERY helpful.
- The need to pester students with questions, rather than giving them answers. The need to consider WHY students might be disinterested or frustrated.

# What Students Dislike

- It felt like there was a lot of reading (nearing too much)
- There was not enough time to fully explore each other's ideas.
- One thing I had to get use to was the format of literature associated with educational research ... the overall style was slightly different than the familiar style in which I write and read.
- The amount of reading. I AM an engineer.
- Less time on *Understanding by Design*. More on general psychology and neurology. Much more on important trends specific to higher education and engineering. We didn't spend much time talking about technology in the classroom.

# Questions / Discussion

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