Designing Innovative Higher Education Programs: Insights from Research and Practice

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Learning Impact Through Teaching Innovation
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It could well be that faculty members of the twenty-first century college or university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments. - James Duderstadt, 1999 [Nuclear Engineering Professor; Dean, Provost and President of the University of Michigan]

Guiding Questions

• What are we preparing students for?
• How will we know if we succeeded?
• What do we do to prepare them?
• Are there models and resources available to assist?

Resources

• Bransford, Vye and Bateman – Creating High Quality Learning Environments
• Pellegrino – Rethinking and Redesigning Curriculum, Instruction and Assessment

http://books.nap.edu/openbook.php?record_id=10239&page=159
http://www.skillscommission.org/commissioned.htm

Backward Design
Wiggins & McTighe

Stage 1. Identify Desired Results
Stage 2. Determine Acceptable Evidence
Stage 3. Plan Learning Experiences and Instruction


Effective Course Design
(Felder & Brent, 1999)

Goals and Objectives

ABET EC 2000
Course-specific goals & objectives

Bloom’s Taxonomy

Technology

Cooperative learning

Students

Instruction

Assessment

Lectures

Labs

Other experiences

Tests

Other measures

Model 1
The Key Components Of INTEGRATED COURSE DESIGN

Learning Goals
Teaching and Learning Activities
Feedback & Assessment
Situational Factors

A Self-Directed Guide to Designing Courses for Significant Learning

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Preparing Students for an Interdependent World:
Role of Cooperation and Social Interdependence Theory

The World is Flat

"Clearly, it is now possible for more people than ever to collaborate and compete in real-time, with more people, on more kinds of work, from more corners of the planet, and on a more equal footing, than at any previous time in the history of the world"

Age of Interdependence

Tom Boyle of British Telecom calls this the age of interdependence; he speaks of the importance of people’s NQ, or network quotient – their capacity to form connections with one another, which, Boyle argues is now more important than IQ, the measure of individual intelligence.

The great question of this new century is whether the age of interdependence is going to be good or bad for humanity. The answer depends upon whether we in the wealthy nations spread the benefits and reduce the burdens of the modern world, on whether the poor nations enact the changes necessary to make progress possible, and on whether we all can develop a level of consciousness high enough to understand our obligations and responsibilities to each other.

Interdependent World

- Essential knowledge, skills, habits of mind, ... for an interdependent world?
  - Reflect individually and list essential skills ~ 1'
  - Turn to the person next to you ~ 2'
    - Introduce yourself
    - Compare lists
    - Develop a joint list
  - Present to whole group (if randomly selected)

Successful Attributes for the Engineer of 2020

- Possess strong analytical skills
- Exhibit practical ingenuity; possess creativity
- Good communication skills with multiple stakeholders
- Business and management skills; Leadership abilities
- High ethical standards and a strong sense of professionalism
- Dynamic/agile/resilient/flexible
- Lifelong learners

Desired Attributes of a Global Engineer*

- A good grasp of these engineering science fundamentals, including:
  - Mechanics and dynamics
  - Mathematics (including statistics)
  - Physical and life sciences
  - Information science/technology
- A good understanding of the design and manufacturing process (i.e., understands engineering and industrial perspective)
- A multidisciplinary, systems perspective, along with a product focus
- A basic understanding of the context in which engineering is practiced, including:
  - Economics and finance
  - The environment and its protection
  - The history of technology and society
- An awareness of the boundaries of one’s knowledge, along with an appreciation for other areas of knowledge and their interrelatedness with one’s own expertise
- An awareness of and strong appreciation for other cultures and their diversity, their distinctiveness, and their inherent value
- A strong commitment to team work, including extensive experience with and understanding of team dynamics
- Good communication skills, including written, verbal, graphic, and listening
- High ethical standards (honesty, sense of personal and social responsibility, fairness, etc)
- An ability to think both critically and creatively, in both independent and cooperative modes
- An ability to impart knowledge to others
- Curiosity and the accompanying drive to learn continuously throughout one’s career

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Backward Design

Stage 1. Identify Desired Results

Filter 1. To what extent does the idea, topic, or process represent a big idea or having enduring value beyond the classroom?

Filter 2. To what extent does the idea, topic, or process reside at the heart of the discipline?

Filter 3. To what extent does the idea, topic, or process require uncoverage?

Filter 4. To what extent does the idea, topic, or process offer potential for engaging students?

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Stage 2. Determine Acceptable Evidence

Types of Assessment

Quiz and Test Items:
Simple, content-focused test items

Academic Prompts:
Open-ended questions or problems that require the student to think critically

Performance Tasks or Projects:
Complex challenges that mirror the issues or problems faced by graduates, they are authentic

Taxonomies

Bloom’s taxonomy of educational objectives: Cognitive Domain (Bloom & Krathwohl, 1956)

A taxonomy for learning, teaching, and assessing: A revision of Bloom’s taxonomy of educational objectives (Anderson & Krathwohl, 2001).

Facets of understanding (Wiggins & McTighe, 1998)

Taxonomy of significant learning (Dee Fink, 2003)

A taxonomic trek: From student learning to faculty scholarship (Lee Shulman, 2002)
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Pedagogies of Engagement

Cooperative Learning Research Support

Over 300 Experimental Studies
First study conducted in 1924
High Generalizability
Multiple Outcomes

Outcomes
1. Achievement and retention
2. Critical thinking and higher-level reasoning
3. Differentiated views of others
4. Accurate understanding of others’ perspectives
5. Liking for classmates and teacher
6. Liking for subject areas
7. Teamwork skills
Goal – All students have access to supportive, excellent undergraduate education in science, mathematics, engineering, and technology, and all students learn these subjects by direct experience with the methods and processes of inquiry.

Recommend that SME&T faculty: Believe and affirm that every student can learn, and model good practices that increase learning; starting with the student’s experience, but have high expectations within a supportive climate; and build inquiry, a sense of wonder and the excitement of discovery, plus communication and teamwork, critical thinking, and life-long learning skills into learning experiences.