Technopreneurship

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Map of this Talk

What is technopreneurship?

Why teach entrepreneurial skills?

How do “adaptive” engineers differ from “inventive” engineers and entrepreneurs?

My efforts in trying to bring change to engineering education

Progress at MTU toward the teaching of innovation
Technopreneurship

Technopreneurship is the merging of knowledge in technology with entrepreneurship skills.

It requires not only technical knowledge but also a thorough understanding of creativity, the innovation process, marketing, finance, and strategic thinking.
Why Teach Technopreneurship Skills to Engineers and Scientists

- To support regional economic development
- For student skill development—to help engineers and scientists to better understand the business side
- To increase the University’s competitive edge
- To increases the nation’s competitiveness in this century’s global economy

“Our nation needs engineers who not only can solve engineering problems but can participate in bringing ideas and products to market”

Frank Huband, Director, ASEE
Importance of Entrepreneurship

• Entrepreneurs form the lifeblood of a healthy economy: they create new jobs, new wealth, new opportunities.

• From 1948-1998, entrepreneurs led the US out of every recession.

• Small entrepreneurs are responsible for 67% of inventions and 95% of radical innovations since World War II.

• In the US, 700,000 new businesses are started each year; 60% of new jobs are created by 10% of the fastest-growing new companies.
Benefits of Entrepreneurship Programs

Compared to traditional MBA graduates, entrepreneurship graduates were:

- Three times more likely to start new business or be self-employed
- Earning annual incomes 27% higher; owning 62% more assets
- If working for a large corporation, earning $23,000/year more
- More satisfied with their jobs; more likely to innovate
- Dramatically increasing sales growth in small firms (by 900%)
- Working for high-tech firms in greater numbers
- More involved in research and new product development

_Entrepreneurship Education Impact Study_
_Eller College of Business, University of Arizona, June 2000_
“We are seeing a lot of graduates who have specific skills and interview well in technical interviews, but what we rarely see is the ability to use the right-hand side of the brain—creativity and working in a team.”

Wayne C. Johnson, VP, Hewlett-Packard
Higher, Faster, Cheaper, Improved

The Adaptive Entrepreneur/Engineer
New Risky Breakthrough

The Inventive Entrepreneur/Engineer
Two Types of Engineers/Entrepreneurs
Based on Michael J. Kirton’s KAI Model

**ADAPTOR**
- Solves problems in tried and understood ways.
- Works for slow, incremental change: continuous improvement.
- Seen as authority in current paradigm.

**INNOVATOR**
- Discovers problems and avenues of solution; questions assumptions; reframes problems.
- Takes control in unstructured situations; invents. Provides dynamics to bring about radical changes, new paradigms.
- Seen by Adaptors as unsound, impractical, shocking.

continued
## Two Types of Engineers/Entrepreneurs

Based on Michael J. Kirton’s KAI Model

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<tr>
<th>ADAPTOR</th>
<th>INNOVATOR</th>
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<tr>
<td>• Precise, reliable, disciplined, prudent, conforming.</td>
<td>• Impatient with routine and detail; works best at the fringes.</td>
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<td>• Essential to the functioning of the system.</td>
<td>• Valued for communicating information on advanced technologies.</td>
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<td>• When collaborating with Innovators, supplies stability, order, and continuity to the partnership.</td>
<td>• When collaborating with Adaptors, supplies strategic vision and breakout ideas, although perceived as undisciplined and chaotic.</td>
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Typical HBDI Profile of Successful Business Leaders

FROM LEFT-BRAIN TO RIGHT-BRAIN THINKING
Discoverers research phenomena

Inventors become entrepreneurs

Problem Solvers work on given problems

Initiators find new problems to solve

Assistants “plug and chug”

Creators “dream up” ideas

What Type of Engineers Are We Graduating?

© 1987, Bill Spurgeon, NSF
Thinking Preference “Tilt” of 2006 Engineering Capstone Design Class (N = 117)

Preferences for Creativity and Innovation

Preferences for Left-Brain Analysis and Procedures

Preferences for Teamwork and Communication

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What Have I Been Doing to Effect Change?
Creative Problem Solving (CPS)

1980s  CPS/Brainstorming Manuals for ASI/Ford & Others
       CPS for Secondary School Students/Teachers

1990s  CPS Classes for Engineering Freshmen, Toledo
       CPS Classes for Engineering Freshmen, MTU*
       C3P High-Tech Education Program at Ford
       BOOK (co-author): CPS - Thinking Skills for a Changing World
       BOOK (co-author) on CPS & Engineering Design
       Pilot CPS/Entrepreneurship Class at MTU

2000s  Sabbatical at University of Nottingham (UNIEI)
       MSc Program in Innovation & Entrepreneurship
       BOOK (co-author) on Entrepreneurship
       CPS Integrated into New Capstone Design Course at MTU

*Discontinued at Start of Common First Year in Engineering
Creative Problem Solving Steps and Mindsets Superimposed on the Herrmann Model

1. Problem Definition
2. Idea Generation
3. Creative Idea Evaluation
4. Idea Judgment
5. Solution Implementation

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Entrepreneurship from Creativity to Innovation, ©2007, 200 pages; by E. Lumsdaine (U.S.) & M. Binks (UK)

See www.InnovationToday.biz

This book is used at the University of Pretoria (South Africa) for a class in innovation by all engineering freshmen and at the University of Nottingham for a required entrepreneurship course for all business and many engineering students.

It is also used in Korea, Malaysia, Singapore, and Slovenia.
An earlier edition was translated into Korean.

A revision is planned for my next sabbatical in 2008-2009.
Capstone Design Course Objectives

- Meet the ABET criteria (see ASEE Paper)
- Prepare students to compete successfully in the global marketplace
- Thoroughly teach the contextual design process—this includes creativity, teamwork and effective communication
- Enable students to meet the sponsor and customer requirements
“I took the creative problem solving course as a freshman because it was “different.” I like the textbook; it shows how people think differently. I can build on this, be positive, communicate better, and get my work done when I capitalize on my understanding of how other people think. It makes teamwork more effective.

As class assistant, I have been able to build up my skills. It is exciting to see people change; this in turn has encouraged me even more. I now think creatively all the time—it’s fun, and it lets me find good solutions.”

Chad Mockerman

Note: He changed, too—he became an engineer with both left-brain and right-brain thinking skills.
“I find it interesting that higher education is still attempting to understand the importance of innovation. As we look around the globe we see that the successful companies and people have one thing in common, they innovate.

While sales of existing products in new markets can be a contributor to organic growth, innovation is the key to dramatic organic growth.

Ingersoll Rand identifies innovation as so crucial to its success that it includes it as one of six Enterprise Focus Areas.”

Chad Mockerman
Global Leadership EFA Program Manager, Ingersoll Rand
“Since completing a Creative Problem Solving course at Michigan Tech in 1993, I have consistently been able to use the knowledge and tools from the course to fulfill this need for innovation, such as using whole-brain thinking to identify new opportunities for providing "out of the box" solutions to customers and leading Lean Six Sigma Kaizen events.

In a world where a continuous improvement culture is required for success, only those who understand innovation processes and tools will lead.

I challenge us all to ask what we are doing to develop the next generation of innovative thinkers? Most of us can be taught to solve equations. But how many of us can identify and drive the next paradigm shift?”

Chad Mockerman, Ingersoll Rand
“Of the 244 credits I earned throughout my undergraduate education, the Invention & Entrepreneurship class has without a doubt been the most important influence in my engineering career.

My future plans include starting and running my own business, and I feel that this class was the only one offering any insight to that path.”

Matt Podominick, 1999

He took a job as a mechanical engineer at Ford Motor Company and owns a successful real estate business.
“While enrolled at MTU, I developed a few creative ideas. But I had no clue how to go from idea to market. I never even heard the term “business plan” until as a senior I signed up for Dr. Ed Lumsdaine’s Invention and Entrepreneurship course.

I am about to license a concept that originated in that class. Also, my senior design project surprised everyone because it was the only market-driven design.

I strongly urge that a full semester course on entrepreneurship be mandatory for all engineering students.”

Rob E. Smith, BSME, MSME 2003
Engineer for Thermoanalytics and
President, Superior Design Innovations