What your Mother Never Told You: The Need for Entrepreneurship Education

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Why we ‘do’ physics
Doing Physics is NOT being a “Physicist”*

* Also true for Every field of study
(Oh, and what IS a physicist, anyway?)
Since 

- Most physics students won’t become ‘physicists’

... and especially, not faculty! (less than 3%)
But

Physicists can do (nearly) anything!!

(That’s how we sell physics to students…)
Your Experience

• What skills and knowledge do you wish you had before you started your professional career?
  – Aren’t those skills universal...applicable to any career?
• What was it like to learn ‘on the job’?
• Is the school of ‘hard knocks’ the best way to prepare for the future?
Two Areas Need Attention

• Career Development
  – Give everyone the skills/knowledge/attitudes needed for success

• Opportunity Recognition
  – Leverage all of the steps in physics research to create/improve products and services
Getting Ready for the REAL WORLD

• College classes (typically) teach knowledge and skills in physics
• Success in the Real World requires other skills, such as:
  – Dealing with People
  – Dealing with Money
  – Dealing with Legal/Regulatory/Political issues
• All careers require these skills
  – Faculty may say otherwise….but everything is a business
  – Whether starting a venture or taking a position these skills are critical for success
What Else Should be Learned?

- Knowledge
  - Business communications
  - Intellectual property
  - Business structures and cultures
  - Incorporation
  - Finance
  - Taxes
  - Legal Regulation
  - Bids and Proposals
  - Contracts
  - Purchasing and Property
  - Dress and Appearance

- Skills
  - Writing
  - Speaking
  - Listening
  - People Management and Teamwork

- Attitudes
  - Entrepreneurial Mindset!
  - Innovation and Commercialization
Where is this Happening Now?

• Primarily in *Engineering Programs*
  – Freshman and Senior Design courses now typically include entrepreneurship
  – Career skills built into ABET standards
• Joint programs between Engineering schools and Business schools
  – Typically on ‘large’ campuses
  – Often graduate programs
• Supporting organizations: ASEE and NCIIA (More on this later... )
What is Available for The ‘General’ Population?

- ‘Bridge’ Programs
  - Tuck Business Bridge Program
  - MiddCORE Program at Middlebury College
- MBA Programs
  - Entrepreneurship concentrations are now common
  - Technical content added to MBAs
    - Example: *Lab to Market* program at Univ. of Maryland
- Business Majors and Minors
  - What some parents see as the ‘right answer’
What is Being Done in Physics?

- Undergraduate entrepreneurship programs
  - Carthage ScienceWorks program
  - UC-Denver innovation program (Randall Tagg)
- Professional Master’s Degrees
  - Case Western Reserve University started the paradigm
  - 14 Programs around the US
One Example: *ScienceWorks* at Carthage
ScienceWorks at Carthage

Courses (Aimed at Juniors)

- ESNS 310/320: Core Business Content
- ESNS 325 (J-Term): Commercial Technologies

[Total: 8 Credit Hours]

Supporting Coursework

- Accounting/Finance/Marketing
- Ethics
- GIS
- Public Speaking

[4 Credit Hours]

Senior-Level Business Plan Courses

- ESNS 410/430: Full-fledged Business Plan
  - New Product
  - New Business/Spinoff
  - SBIR/IR&D Proposal

Defended before Advisory Board of Experts

[Total 8 Credit Hours]
• Goals and Plans
• Technology/Innovation
• Writing/Correspondence
• Entrepreneurs/characteristics
• Marketing Principals
• Product Lifecycle
• Project Management
• Financial Needs
• Marketing and Sales
• Searching for Business Info.
• Speaking/Presentations
• Information Systems
• Web Design/Social Media
• Economics
• Budgeting: Personal and Business
• Business Plans
• Stocks and Bonds

• Investing/Retirement
• Resumes and Interviewing
• Creativity and Ideation
• Business Models
• Incorporation and Business Organization
• Management and Team Skills
• Intellectual Property
• Accounting and Financial Management
• International Business and Cultures
• Legal and Regulatory
• Geographic Information Systems
• Finance and Funding
• Taxes
• Bankruptcy
• Ethics
• Bid and Proposal
• Contracts/Subcontracts/Purchasing
• Insurance/Risk Reduction
Does this Work?

- **ScienceWorks** has helped Carthage science students succeed
  - Jason Benes: $1.1M Royalties from Nike
  - Liz Zona: Abbott Labs
  - Brian Jones: Medical administration executive
  - Chris Duffy: Epic Systems
  - Melissa Lowe: Ortho McNeill
  - Keith Kobelt: Marsh and McClennan finance
  - Charlie Staniger: Walgreen’s management
Assessment Results

- Carthage SciencWorks graduates are the most successful produced by the college
- More rapidly hired
- More rapid promoted
- More accepted into graduate schools
- More highly rated by employers and advisers
Ancillary Benefits

• Recruiting!!
  – Prospective students are more interested in physics if career preparation included
  – PARENTS are particularly positive

• Alumni engagement
  – More successful alumni reflect back and contribute to department success

• Competition
  – Physics viewed as a career path – like (or even better) than engineering
Other Modalities
Too big a mouthful?

- Speaker Series
- Guest lecturers
- In-course projects/content
  - Innovation projects
- Visiting businesspersons (‘Entrepreneur in Residence’)
- Interdisciplinary courses and projects (cross-department)
- Industrial internships
Building the Skill Set

- Hire ‘Professors of Practice’
  - Started by UT-Austin as a staffing model
- Take advantage of National Collegiate Inventors and Innovators Alliance meetings and resources/publications
  - Large body of information, curriculum, documentation, roadmaps, etc., already available
  - A great community looking to work together
- Engage alumni, regional businesses, economic development organizations
Innovation in Physics
INNOVATOR

ENTREPRENEUR/INTRAPRENEUR

INVENTOR
Where could ideas come from?

- Every step in the research process could result in innovation
- Research has an *end goal* in mind
  - But the innovation may be an *intermediary step*
What Needs to Happen? A Shift in Mindset

• How could my research have commercial value?
  – Directly or Indirectly?
• Can I recognize opportunities?
• Can I answer ‘Who needs it?’
• Do I document/record information to allow me to protect my ideas?
• Can I develop partnerships and linkages to bring products and processes to market?
What Can Be Done?

• Step One: Implement *innovation* as an attitude
  – In research
  – In teaching and education

• Step Two: Look at every step in the process as an opportunity to develop viable products or services
  – Take appropriate IP precautions

• Step Four: Seek out expertise!
  – There is a community of entrepreneurial faculty and national organizations

• Step Five: Promote student creativity at all levels
  – Young creativity is *Powerful*

• Finance, inventory control, order tracking - it’s all just *data!*
Implications for the Academy

- Changes needed in goals/outcomes/assessments
  - What is the right set of assessable outcomes for students and faculty?
  - Do ‘traditional’ curricular structures achieve these goals?
  - Do ‘traditional’ delivery methods work in this environment?

- A shift in the traditional research process
  - Grant supported research with other than ‘predictable’ outcomes

- Changes in academic IP policies
  - Technology Transfer offices can be a help or hindrance
Resources: You are not alone

- National Collegiate Inventors and Innovators Alliance (www.nciia.org)
  - Technology entrepreneurship and innovation
  - Come to the meeting in three weeks!
- General entrepreneurship organizations:
  - Collegiate Entrepreneurs Organization (CEO)
  - United States Association of Small Business and Entrepreneurship (USASBE)
- Engineering Education:
  - American Society for Entrepreneurship Education (ASEE)
Join the Crowd

- Conferences in 2014 on Entrepreneurship in Physics:
  - *Reinventing the Physicist* (sponsored by APS)
    - College Park, MD, June 2014
  - AIP/ACTP Industrial Physics Forum
    - Sao Paolo, Brazil, Sept. 28-Oct. 3, 2014
- Note the National Collegiate inventors and Innovators Alliance – Annual meeting March, 2015, Washington, DC