Session 2354

An Interdisciplinary Graduate Course in Technology Entrepreneurship

Steven P. Nichols
Associate Vice President for Research, and
Director, Murchison Chair of Free Enterprise

Norman Kaderlan
Associate Director, IC^2 Institute

John S. Butler
Chair, Department of Management

Mary Ann Rankin
Dean, College of Natural Sciences

The University of Texas at Austin
Austin Texas

Abstract

Commercialization of new technology (and new applications of existing technology) involves a complicated mixture of disciplines that require technical, financial, business, marketing, legal, and other expertise. Faculty in the College of Engineering at the University of Texas at Austin (UT-Austin) recently examined the philosophical justification of offering course material involving the technical enterprise (entrepreneurship) into the engineering curriculum. One of the important issues considered by the faculty was the question of what should be taught in engineering and what should be taught in business and other disciplines.

This paper discusses the educational and philosophical approach to development of the multi-disciplinary course (titled "The Enterprise of Technology: From Lab to Market") as well as considerations in the implementation of the course.

1. Introduction.

In the wake of the tech market bust … universities remain committed to teaching entrepreneurship, students are advancing novel technological solutions to age-old problems, and venture capitalists are putting their money on the line.

Bruce Auster
Prism, January 2002[i]

Many engineering faculty have recognized the advantages in including innovation, creativity, and entrepreneurship in engineering education. The literature includes discussions of the role of entrepreneurship in engineering education. As an example, Nichols described the educational objectives behind including entrepreneurship in engineering education at the University of Texas at Austin.[ii] The literature also includes discussions of specific programs and courses in innovation, creativity and entrepreneurship. The October 2001 issue of the Journal of Engineering Education contained a number of articles based on the he Annual Meeting of the National Collegiate Inventors and Innovators Alliance (NCIIA). In that volume, Wang described programs at the University of Nevada, Reno,[iii] Sullivan described a program in innovation and entrepreneurship at the University of Colorado at Boulder,[iv] and Marchese described a venture capital fund for undergraduate Engineering Students at Rowan University.[v]

Faculty in schools of business, science, medicine, law, and communications (*inter alia*) have also examined the role of entrepreneurship in education programs involving those disciplines. Engineering faculty have developed cross-disciplinary courses and programs in cooperation with other disciplines. As examples Ochs described programs at Lehigh University involving multidisciplinary entrepreneurial education activities,[vi] and Miller described early experiences in cross-disciplinary education at Stanford University involving biomedical technology.[vii] This paper describes an interdisciplinary course in the "Enterprise of Technology" developed and offered at the University of Texas at Austin (UT-Austin).

2. A Course In Interdisciplinary Entrepreneurship Education.

Goal 3: Foster innovation in engineering research and practice, encourage entrepreneurship and promote leadership in engineer's service to society.
Strategic Plan
College of Engineering
The University of Texas at Austin

The College of Engineering at UT-Austin has developed (and continues to develop) courses in engineering entrepreneurship, [viii] creativity and innovation, and product development[ix] for a broad cross-section of students. The College has also developed

material and courses designed for students with specific interest in entrepreneurship and start-up businesses. In a recent program funded by Ford Motor Company, the College of Engineering worked with the McCombs School of Business to develop a series of education modules that offer to engineering students (and recent graduates) material in accounting, finance, and other business concepts.[x]

The cooperation with the School of Business serves as a model for cooperation with other disciplines at UT-Austin in support of engineering entrepreneurship education. Faculty from the College of Engineering worked with faculty from the School of Law, the McCombs School of Business, the College of Natural Sciences, and with research staff at the IC^2 Institute to develop a graduate course titled "The Enterprise of Technology: From Mind to Market".

Note: The reader may be more familiar with the academic units (business, law and sciences) than with IC^2. The IC^2 Institute is an organized research unit of UT-Austin focusing on technology commercialization. The Institute has received recognition international recognition as a leader in science and technology commercialization. IC2 also manages the Austin Technology Incubator (ATI). ATI has received the Justin Morrill Award from the Technology Transfer Society and the Randall M. Whaley Incubator of the Year Award from the National Business Incubation Association.[1]

The three semester-credit hour graduate level course is listed in four colleges (engineering, business, natural sciences, and law) and provide an opportunity for students from all four academic programs to work with student colleagues who have significantly different academic backgrounds (and perspectives) than themselves. The course focuses on activities involved in the development and commercialization of technology with an emphasis in commercializing technology from university laboratories. The course combines traditional lectures emphasizing the theory of product development and of product (and service) commercialization. The course used numerous outside speakers who emphasize more pragmatic aspects of product development and commercialization.

The course requires students to

- -Develop a process framework for commercialization of technology from the laboratory to the marketplace within a university context,
- -Develop an understanding of how to assess technologies for commercialization potential,
- -Develop an understanding of how to create a commercial venture based on technology, and
- -Develop an understanding of the role of intellectual property and licensing.

[1] For more information on IC2, see, http://www.ic2.org.

2. Student Projects

As part of the course requirements, students formed cross-disciplinary teams to examine commercialization potential for proposed technologies. The faculty were willing to suggest specific technologies for the teams but encouraged the teams to consider technologies of particular interest to the students. Each of the student teams pursued technologies from laboratories or researchers at UT-Austin. (The graduate students from engineering and science provided suggestions for topics based on their experiences and knowledge from working in research projects as graduate research assistants. This promoted the emphasis on commercialization of technology from universities.) The student technology commercialization teams studied potential markets for their selected technologies, identified market barriers and competitors, and examined price sensitivity for identified markets. The teams then re-examined the technologies to understand the research and development necessary to reach the market of interest and proposed a venture plan for the commercialization of the technology.

3. Faculty Lectures: Combining Design Methodology and Commercialization Methodology

The course was organized around one three-hour lecture per week. This allowed ample time in the classroom to develop process models (for technology development, product development and product commercialization) and allowed time to examine the practical application of various models. The mix of students from engineering, business, law, and sciences provided an interesting challenge (and opportunity) to develop common concepts from a varied educational background. Lectures involved a description of the engineering design process and a description of "new product" commercialization process.

Commercialization lectures presented the Jolly Model (with modifications) for technology commercialization.[xi] Some of the business students had previous exposure to the model, but had not viewed the process as an opportunity only to commercialize a new product. These students generally had considered using the process only to commercialize a "new product" developed by others, but they had not considered using the process to define (and improve) the product *per se*.

Product Development lectures described the engineering design process presented by Pahl & Beitz[xii], Pugh,[xiii] Otto & Wood,[xiv] and others. While many of the engineering students were familiar with the engineering design models discussed in class, the models took on new dimensions when viewed from the perspective of the commercialization models.

The combined models provided a philosophical framework by which engineering and science students could better communicate to business students in the development of technologies and in the commercialization of those technologies. Neither of the two

approaches, however, provided for a protection of the potential intellectual property of interest to the students.

4. Guest Lectures and Guest Speakers

The course took advantage of thirteen guest speakers during the semester. (Table 1, below, provides a listing of the guest lectures, guest speakers, and related topics for their presentations from the Spring of 2001.) The speakers were selected to supplement the material presented by the instructors and to match specific topics covered in the course.

The guest lectures were prepared by faculty at UT-Austin to develop an intellectual framework of two specific topics. One of the guest lectures was designed to develop an understanding of the historical perspective of technology (guest lecture by Professor Butler, Chair of the Department of Management). Dr. Butler's lecture discussed entrepreneurial activities over a 2,500-year time frame. The second guest lecture was designed to develop an understanding of the fundamentals of intellectual property (guest lecture by Professor Reese, School of Law).

Guest speakers provided pragmatic experience and examples of classroom topics. Note that the topics and speakers had a heavy emphasis on technology commercialized out of universities. Presentations by Professor Beaman (Chair, Department of Mechanical Engineering), Professor Faulkner (President, UT-Austin), and Professor Sessler (Professor, Department of Chemistry) discussed their own experiences in commercializing technologies out of their own research laboratories.

The class also observed marketing presentations to venture funds made by companies associated with the Austin Technology Incubator.

Table 1. Guest Speakers and Topics

Name/Affiliation	Title	Classification/Topic
Judge Alan Albright Gray, Cary, Ware & Freidenrich	Attorney (Former Federal Magistrate)	Guest Speaker Litigation Experiences in Intellectual Property
Dr. Joseph Beaman --- Department of Mechanical Engineering UT-Austin --- DTM, Inc.	--- Chairman --- Founder	Guest Speaker Founding of DTM Example of Commercialization of Technology at a Universities
Professor John Sibley Butler Department of Management	Chair	Guest Lecture Historical Perspective of Entrepreneurship
Mr. Tomas L. Churchwell ARCH Development Partners University of Chicago	Managing Partner	Guest Speaker A Model for Commercialization of Intellectual Property at Universities
Mr. Michael Davis Haynes and Boone	Attorney	Guest Speaker Non-Disclosure Agreements and Legal Implications
Dr. Larry Faulkner University of Texas at Austin	President	Guest Speaker Example: Commercialization of Intellectual Property at Universities
Mr. Mark Murdock Thompson Knight	Attorney (Former General Counsel)	Guest Speaker Intellectual Property Strategy
Dr. Jonathan Sessler, , Department of Chemistry	Professor	Guest Speaker Example: Commercialization of Technology from Universities
Mr. Steve Straus Austin Ventures	General Partner	Guest Speaker Venture Funding
Professor Anthony Reese School of Law	Professor	Guest Lecture Fundamentals of Intellectual Property
Dr. Jim Truchard National Instruments	Founder, Chairman	Guest Speaker Founding of National Instruments
Mr. Terry A. Young Texas A&M University Association of University Technology Managers	Executive Director, Technology Licensing Office President	Guest Speaker Intellectual Property at Universities
Mr. Niel Webber Vignette	Co-Founder	Guest Speaker Founding of Vignette

5. Post Script

The class examined three technologies. One of those technologies (electromechanical active suspension systems for off road vehicles) was the subject of a subsequent proposal involving research and development for commercialization. The proposal received joint government and private funding totaling approximately $1 million. This course was not designed to lead to direct commercialization of technology from universities, but this particular project reflects well on the concept of cross-disciplinary development of commercialization activities.

References and Bibliographic Information

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