

**UTILIZING ENGINEERING ENTREPRENEURS
TO INSTILL AND ENHANCE ENTREPRENEURSHIP
IN TODAY'S STUDENT POPULATION**

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ABSTRACT

Meeting the dual challenges presented in today's engineering schools by the bright, energetic student with the dream of turning her ideas to riches, and awakening the interest of the research, detail oriented, single solution student to the vagaries of the market place and the entrepreneurship; harnessing energy and enthusiasm, without stifling it, teaching the basics of business finance, market cap, accounting, law, intellectual property, etc., without turning the motivated student off while instilling an entrepreneurial mind set in the researcher are the tasks of the teacher of entrepreneurial studies.

To meet these challenges, at Cooper Union we are drawing on the talents of our engineering alumni, friends and members of our extended family to deliver to students their first round of education in developing an entrepreneurial venture and an entrepreneurial outlook on activities. Participants in the entrepreneurship course are required to form teams of not less than three nor more than five members and develop a business plan for a product or service of their choice. This development of a plan is a model that has long roots in entrepreneurial education at the business schools of America.¹ We, at Cooper Union, are utilizing a combination of case studies, guest lectures and off campus visits to deliver the required tools and motivation. The course culminates in the student presentation of their business plans to their classmates and a group of venture capitalists.

THE PROGRAM AT COOPER UNION

To support the entrepreneurial curriculum and to participate in the classroom, both for imparting the tools and for plan review, the course director seeks out and recruits from

the school's trustees, engineering graduates, engineering council advisers, business owners and personal friends, individuals with substantive experience in entrepreneurial businesses, good presentation skills and an interest in sharing their experiences and knowledge with students. Nothing brings a case study more alive than to have an entrepreneur who has personally walked the case study's path appear in the classroom.

To illustrate the forgoing, this paper focuses on the following substantive areas and the integration of the guest lectures into the course to enhance student development and the quality of the students learning from the first class session through the development and presentation of their business plans².

Areas where guest lecturers have been and are being utilized include:

- Engineering entrepreneur role models describing
 - Start-up operations
 - Going public: what happens to the entrepreneurial spirit
 - Being acquired: the role changes that occur

The basics of business through experts that the entrepreneur will need

- Marketing
 - Customers who are they, do I need them?
 - Branding, what is it

- Legal
 - Intellectual property
 - Licenses required to be in business
 - Contracts
 - Laws affecting business

- Accounting/finance
 - Books and records
 - What are financials
 - Taxes

Finally, we bring the semester together through student team business plan presentations where venture capitalists are the audience and the students the presenters.

HISTORY

In the fall of 1995, Cooper Union's Engineering Advisory Council (a group of engineering graduates and friends of Cooper with an interest in the school's curriculum and activities) which meets regularly with the Dean of Engineering suggested that more entrepreneurial activities be under taken by the school's students. In May 1996, Dean

Eleanor Baum asked me if a course in entrepreneurship could be crafted and delivered in the upcoming Fall semester. I said yes!

Finding models for entire entrepreneurial degree programs, e.g.: MBA, business college major, etc. was rather straight forward, but our objective was a single, one semester elective undergraduate course, say fourteen meetings of three hours each, delivering content, not merely a survey, with tangible experiential learning. By way of example, The Stern School of Business at New York University, The Wharton School of the University of Pennsylvania, and The Rensselaer School of Management at The Rensselaer Polytechnic Institute, as well as many others, had significant course offerings in entrepreneurship³. Many books and textbooks were readily available⁴, as the course has evolved additional texts⁵ and materials have surfaced and been drawn upon⁶.

Clearly, expertise in many subject areas was required to effectively deliver a meaningful course to intense bright engineering students. Students would not suffer a course that did not deliver. How to develop the expertise? The excitement? As I organized the contextual framework, these questions haunted me.

In my previous teaching, at Pace University Law School, I conducted a course in environmental science for lawyers obtaining a Master's in Environmental Law. That course utilized a number of distinguished scientists as lecturers, each delivering one or two lectures, in specific subjects e.g.: food cycles in aquatic environments, soil chemistry, botany, sewerage treatment, etc. It had worked well. Where to find the experts for entrepreneurship?

THE BEGINNINGS

My criteria for guest lecturers was expertise, and an ability to present. The subject matter for the lectures were the units set out in the course outline⁷, the syllabus was not yet fully defined. The issue was to find persons with the time and the interest in participating. I spent a good deal of time during the summer of '96 talking about the up coming class with anyone who would listen. Many had suggestions, including possible speakers, I persevered. Caveat, do not underestimate the time required to bring guests to a program, in many cases doing it "yourself" is less time consuming.

My first two recruits were MBA's, my son and his former business school roommate, both in their late twenties, they would present marketing and a breakeven analysis. The marketer was employed by a major consumer marketing entity and the breakeven analyst by a major consulting firm. While on a vacation trip in Maryland I stayed at a B&B run by a computer programmer with a special niche in Custom's brokerage. We talked about how he developed his business. This individual emphasized the need to focus and follow through. He reported that his biggest problem was having his employees finish what they started and not continuing to add *new wrinkles* and *great ideas* to the task at hand thereby never finishing or delivering a product to the customer. Students are taken aback with the concept of finishing and delivering on time a good product rather than missing deadlines

and developing a great product. If a product sells at Christmas, delivering it on December 24, just doesn't hack it.

An engineering graduate of the U.S. Naval Academy, now a CPA and principal in an accounting partnership, spoke on the start-up requirements for a new business venture and gave an overview of accounting basics, it didn't hurt to discover he also was marketing a product he had developed.

To explore the interaction of a start up company with an existing old line company we arranged a full morning class visit followed by lunch with NYNEX (now Verizon) executives, in the senior executive conference room of the company's New York City headquarters. (Two of NYNEX's senior executive officers were on Cooper's board) Entrepreneur Howard Flagg, former President of PairGain Technologies, Inc.(the start-up entity) an engineering alumnus of Cooper Union, joined the NYNEX group from California through a teleconferencing connection.

For intellectual property, the engineering students visited the New York City law firm of Kenyon & Kenyon to meet with attorney John Flock, a Cooper alumnus, who along with several colleagues spoke on copyrights, patents, and trademarks.

History professor Peter Buckley spoke on American entrepreneurship and the legacy of entrepreneur Peter Cooper. Students also met with 1995 Cooper graduate Greg Loibl who, with two Cooper Union engineering professors, had recently received a patent for a chilling device invented in the college's labs.

In the first offering of entrepreneurship we utilized readings from Jeffrey A. Timmons *New Venture Creation* (rev. 4th ed., 1996), and Karl Vesper's *New Venture Mechanics* (1993), along with case studies, such as Jiffy Lube International, Inc. All college computer, library and laboratory resources were available to students in the course. And so it went, a scrambling semester with constant change.

FIRMING UP

But, I had not truly involved the Engineering Advisory Council. As luck would have it during October '96 the Council was meeting and I was invited to attend. I reviewed the background of the members in advance and found that several were financiers or venture capitalists, others were leaders of large entities. I spoke with as many as I could before, during the breaks and after the meeting, two expressed strong interest in participating. My audience for the presentation of the plans was forming. At term end the reviewers included: Pierre Schoenheimer and Don Friedkin, principals of the Radix Group Inc.; Robert Bernhard, President of the investment firm Bernhard Associates and Chairman of Cooper Union's Board of Trustees; Mark Kaufman, venture capitalist; John S. Oler, JSBO Realty and Capital; and Dr. Judith Lyczko, then senior development officer, Cooper Union.

EARLY PROBLEMS

Two significant problems developed during the first offering, 1) the sophistication of the Jiffy Lube case series from the Timmin's casebook created significant teaching difficulties as the student population had an insufficient background in business finance; and 2) the teams were a bit at sea as to organizing and preparing a business plan. To resolve the finance issue a clearer segment on capital and market valuation was installed, and for team organization matters I scheduled and still schedule a one hour meeting with each team to discuss one on one their organization, concepts and planned process for completion of the project. This session is held two thirds of the way through the semester. Additionally, I now require a preliminary market analysis and cost profile at mid semester. These tasks assist in keeping all work on track and give me direct insight into each team members growth and helps form a basis for grading individuals.

CLASS ORGANIZATION

Prior to the start of each offering of Entrepreneurship the syllabus is updated, new readings or texts and the suggestions from the prior course offerings, both student and guest lecturers are considered, as well as, conditions in the capital markets, e.g.: IPO's, newspaper articles on startups, recent alumni activities in industry, tax changes. This, like so much else, is an area of rapid change. From double digit increases to losses! This is also the time of recruiting and scheduling of guests. As one can note our syllabus has a planned development within it. At the start concepts, the idea, the team, followed by tools, what is a market, break even analysis, accounting concepts, taxes, intellectual property, etc. Tying the guests and their schedules to logical pedagogy is a stretch. But we try. Last minute changes do occur and, for these rare occasions, I underscore to the students the need for entrepreneurial flexibility.

Each guest is advised of the assigned readings for the guest's subject matter. Copies of the readings are provided by the instructor. At times, our guests have suggested alternate readings or projects for inclusion in class. Following discussion, they are included or not included as agreed between the guest and the instructor. A good guest always wants to know how much time she has, the background and interests of the students, and the dress (most are now business casual), they ask what is to be covered or what is expected of them. Confirmation of date and time, by letter or e-mail, and follow up two weeks before the session have become common with me and last minute rescheduling is rare. I have not experienced a cancellation in six editions of the course.

To facilitate interaction between the guest and the students I require the students to utilize a tent card with their name for the guest sessions. Guests can thereby easily converse by name with the students and the dialogue is stimulated.

THE STUDENT VIEW

Student business plans have included development of a paper-to-digital page converter, a multi-lingual web site design service, an opera production company, a "WhirlyBall" licensee, and a moving and storage device. In an unsolicited addendum to one business plan, one student team noted:

... through the writing of the business plan, we all feel we have learned a great deal about the entrepreneurial process. None of us were aware of the immense amount of planning and preparation required to start a venture, even something as deceptively simple as a bakery or a “fire” distributorship. Throughout the process, we have seen firsthand the difficulties and benefits that come in working as a team. ... As a result of the project, we all feel we will walk away with a much greater appreciation and understanding of the elements that go into business in general, and a keen awareness of “what it takes.” ... [we also saw that] in the end, with enough drive and provided the idea is good, the venture would succeed.

Cooper’s engineering students that have taken the course have learned from the **curriculum**, through readings, case studies, and research projects; from **others**, through projects in three- and four-person teams and through alumni and guest lecturers; from **experience**, by both developing their own business plans and meeting with experienced entrepreneurs; and from **exposure**, by visiting “real world” business settings -- Kenyon & Kenyon’s law firm and Verizon’s corporate headquarters in New York City -- where they met with entrepreneurs, engineers, lawyers, and business leaders.

While we at Cooper are in New York City and many of our alumni are nearby. We do have participants who, at their own expense, come to campus from distant cities, e.g.: Boston, MA, Washington, D.C., and Los Angeles, CA.

As can be seen the secret of our success to date is openness and a willingness to change. Students evaluate the guests and the guests provide me with feed back on the students. Over time the guests have changed, the needs of their businesses preempt or they do not feel a sufficient internal rush from the experience. However, new persons with experience are continually sought out, appear and provide new blood. Blood, that not only stimulates the student, but also the instructor.

FINDING AND PREPARING GUEST LECTURERS

Now that our program is up and running the main thrust of our course management is to keep the content fresh and stimulating. Close attention to the vagaries of the stock market, its sudden return to a value approach, e.g.: requiring a real price to earnings ratio and once again requiring something more than “dot-com” in your name to be eligible to come to market as an IPO is essential. But the true test is finding and recruiting guests and once recruited working with them so that the subject matter is presented.

“War stories” are of course the stock and trade of our guests whether from classes they attended, teachers they experienced or business issues faced and dealt with. and they are used for the emphasis that they provide. It is one thing for me to advise in my financing session that when one is in business, cash is king and never run out of cash. It is quite another for a guest to tell of the time the payroll needed to be met and he had to mortgage his house to get the cash for the payroll! Or to have an accountant (now corporate controller) described his firm’s flirtation with bankruptcy as a major client did not timely

pay his invoice. The strength of the point made through personal experience is always commented on by students.

Keeping the stories relevant to the topic requires at least two discussions (usually long phone calls) with the speaker. The first to understand the subject matter, the second to confirm scheduling and to get a feel if the speaker will deliver.

As I indicated above, prior to my first talk with the speaker I provide the text of the student reading assignment for the session and descriptions of the projects that the students are planning. When the guest and I talk the guest often indicates that the materials are okay, but ... and then indicates areas that he feels comfortable with or additions that need to be covered or areas to de-emphasize. I work through the points with the guest and we come to an accord. During these discussions I keep in mind that in the ensuing class sessions, areas not covered by the guest can be covered by *me*.

My second discussion with the guest occurs two weeks prior to the class session. We firm up speaker aids, laptop connections, overheads, handouts, etc. and again discuss the upcoming session. Obviously there is no reduction in my class preparation time.

Some guests require guidance during the session – if they ask a question of me I respond – If I feel things are going off track or the presentation is not coming across well – I address it at the break. One guest was asking students questions, the students were reflecting, body movement was present and then the guest answered his own question! At the break I suggested he wait a little longer before answering, the second half was great.

STUDENT FEEDBACK ON GUESTS

Part of the ongoing evaluation of the course is student feedback. For each guest I provide the students with a feedback form that asks them to rate the presentation. Typically I include what did you learn questions. For presentation style, how do you think the visuals were, quality of the handouts. For content, what can you use from this presentation in your project? How would you change the presentation. Finally, should we invite the speaker back. I share the forms with the guest.

PROGRAM DEVELOPMENT ASSISTANCE

Early on, one of the school's development officers guided us to a source of funding for the development of entrepreneurship courses and the enhancement of entrepreneurship. The Ewing Marion Kaufman Foundation, Kansas City, MO. A second source of development funding was the National Collegiate Inventors and Innovators Alliance (NCIIA) Amherst, MA. Each of these organizations provided funding for aspects of our developing program and for some aspects that have not yet reached fruition. One side note. As we stated in our grant applications we expected to have to underwrite the costs of participating guests, e.g.: Honiara and travel expenses. To our chagrin, our expected expenses of startup were significantly lower than expected, our guest lecturers were true volunteers. To a person, they underwrote and continue to underwrite their own expenses

of participation! Travel, handouts, etc. We needed to return unexpended grant money to one of our sponsors.

During the second year of our program an opportunity to participate in the Fourteenth annual Price-Babson Symposium for Entrepreneurial Educators (SEE-14) held at Babson College in May 1998, became available. Professor Gallogly and Mr. Pierre Schoenheimer, a member of the Albert Nerkin School of Engineering Advisory Council and an active supporter of the entrepreneurship program, participated. This one week symposium served to reinforce and enhance the concepts (case studies and guest lecturers) that form the core of the Entrepreneurship course and the follow on programs at Cooper.

Student participation in the course has steadily increased. My hope is that the forgoing somewhat anecdotal report helps you in your endeavors.

Bibliography

¹ See: Annual competitions held for entrepreneurial business plans, and for case study approach see Babson College: A Legacy of Entrepreneurship and the course materials for the annual Symposium for Entrepreneurial Educators conducted at Babson sponsored in part by the Ewing Marion Kauffman Foundation and the Price Institute.

²The Cooper Union Syllabus for ENGINEERING AND ENTREPRENEURSHIP

DESCRIPTION: Students will learn the fundamentals of being an entrepreneur and operating a successful business, from its original idea to the open market. Students will choose an engineering related project or service and learn the principles of accounting, marketing, financing, and continuing research. Students are required to choose their own service or product and write and present a business plan as their final project. Lectures include case studies on the various projects and guest speakers from the industry. Readings include articles from journals and textbooks.

TEXTBOOK: New Venture Experience, Revised Edition, Karl H. Vesper,
Vector Books, 1996

REFERENCES: New Venture Creation, Fourth Edition, Jeffrey A. Timmins
New Venture Mechanics, Karl H. Vesper, Prentice-Hall, 1993
New Venture Structure, Karl H. Vesper

OBJECTIVES. Whether marketing an idea, producing a product or providing a service, the entrepreneur needs to understand the principles of business accounting, financing, marketing, managing and planning. Students form teams of three to five members and prepare a business plan utilizing the principles, concepts and procedures presented in the assigned readings, classwork and by guest lecturers.

TOPICS COVERED

- 1 Introduction - An overview of the course. What is expected.
- 2 The Idea - We continue our discussion of moving from idea to reality and introduce seeking out sources of funding.

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- 3 Accounting- **Guest lecturer** CPA or Finance officer- Description of the start-up paper work for a new business venture and an overview of: assets and liabilities, the income statement, cash vs. accrual accounting and other accounting basics
- 4 The Business Plan. **Guest lecturer** (Entrepreneur or consultant) What is a business plan? Why have one? What it can do for you, a break even analysis. Classroom group exercise to develop the elements of a business plan.
- 5 Financing a Venture. **Guest lecturer** Principal in a venture capital firm. Owner's personal investment, loans, angels, interim financing, mezzanine financing, an initial public offering
- 6 Case Study. The Clay Bord®. A first hand report of a start up venture.
- 7 **Team meetings** - Business plan discussions. Each team meets with the instructor to review team organization and the status and substance of proposed business plan.
- 8 Marketing. **Guest lecturer** What is a market? What is the difference between marketing and selling? Small group development of a marketing plan for fire during the caveman era.
- 9 An Introduction To Intellectual Property **Guest lecture** held at New York City Wall Street Law firm of a Cooper alum : Patents; Copyrights; Trademarks; and, Trade secrets. The proper use of each and the protections they can afford to the holder. Licensing of patents and copyrights is briefly explored.
Visit is also designed to give students an understanding of how a law firm works and the ambiance of such a firm.
- 10 Going Public **Guest lecturer** A discussion of initial financing and the process of taking a company public.
- 11 The Wind Surfer : Case A and Case B. Reviews and reinforces, in a case study format, the benefits of intellectual property protection and how an idea for a business changes with the experiences of the entrepreneur.
- 12 The Benefits Of A Franchise Business. An alternate form of entrepreneurship. The benefits and limitations of becoming a franchiser to grow a business and the view of the franchisee.
- 13 **Business plan presentations** - Teams present their business plan as a request for financial backing of your proposed venture to three guest business/financial executives (Alumni who have started their own business and members of the Cooper Union Board of Trustees or advisory councils). The executives and the class will listen and comment upon the presentation.

³ These schools freely forwarded their course offering materials, which assisted me in the course development process by providing a sequence of materials and a guide to relative time allocations for content.

⁴ E.g.: New Venture Creation, Fourth Edition, Jeffrey A. Timmins; New Venture Strategies, Prentice-Hall, Inc., 1990, Karl H. Vesper; New Venture Mechanics, Karl H. Vesper, Prentice-Hall, Inc., 1993.

⁵ E.g.: New Venture Experience, Karl H. Vesper, Vector Books, 1996; The Entrepreneurial Journey, Thomas J. O'Malia, Brandywine Publishing, Calabasas, CA., 2000.

⁶ Typical books expostulating an entrepreneurial philosophy are: Rich Dad Poor Dad, Robert T. Kiyosaki and Sharon L. Lechter, TechPress, Inc. Paradise Valley, AR. 1997; The Millionaire Next Door, Thomas J. Stanley and William D. Danko, Longstreet Press, Inc., Marietta, GA, 1996. Periodicals, of continuing interest and sources for case studies, are: Inc. Magazine; and Entrepreneur Magazine.

⁷ See note 2, supra.

Biography

Vincent Gallogly holds an appointment as Adjunct Professor of Engineering at The Albert Nerkin School of Engineering of The Cooper Union, where he teaches Entrepreneurship, and Law and Ethics; and has held an appointment as Adjunct Professor of Law at the Pace University School of Law, where he taught Scientific and Technological Issues in Environmental Law. Mr. Gallogly is currently Of Counsel to Tierney, Zullo, Flaherty & Murphy, P.C., Attorneys at Law, Norwalk, CT. His practice includes a

significant focus on business, real estate and environment management issues, stemming from his over twenty-six years of experience as Assistant General Counsel, Real Estate and Environment for GTE Corporation.

Mr. Gallogly received his BCE from the City College, School of Engineering, The City University of New York and his JD from the New York University School of Law. He holds a Professional Engineering license in the state of New York and is admitted to the practice of law in New York and Connecticut.