

A Financial Technology Entrepreneurship Program for Computer Science Students

James P. Lawler
lawlerj@aol.com

Anthony Joseph
ajoseph2@pace.edu

Pace University
New York, New York 10038, USA

Abstract

Education in entrepreneurship is becoming a critical area of curricula for computer science students. Few schools of computer science have a concentration in entrepreneurship in the computing curricula. The paper presents Technology Entrepreneurship in the curricula at a leading school of computer science and information systems, in which students are beginning to learn the theory and practice of skills needed to be business entrepreneurs or opportunists, and not mere scientists. The concentration in entrepreneurship is designed in the current model program in the disciplinary domain of the financial industry. This paper will benefit educators in schools of computer science or schools of business considering enhancement of computing curricula to be contemporary with the demands of industry.

Keywords: computer science, computing curricula, entrepreneurship, interdisciplinarity, technology

1. BACKGROUND

Business firms in industry continue to demand that college graduates have analytical, business and communication skills. In competing for customers globally, firms demand that graduates have creativity and innovation skills. Firms demand that graduates of schools of computer science have such skills and technical skills, in order that they can entrepreneurially furnish competitive edge ideas for processes, products and services improved or infused by computational and informational technology. Graduates of schools of computer science having entrepreneurial skills can invent new products and services if not new technologies. Clearly schools of computer science can begin considering infusing entrepreneurship into the computing curricula for students.

Downsizing of firms due to the 2008- 2009 Crisis on Wall Street is causing parents and students to consider entrepreneurship as a field (Shaff, 2009). Students in schools of computer science may be employed following graduation by entrepreneurial large-sized firms, but in the economy of 2010 they may be employed frequently by entrepreneurial small-sized firms [Charney and Libecap, 2000] in the event of downsizing of the large-sized firms. The small-sized firms have a disproportional larger number of positions than the large-sized firms. Though 2,000+ colleges in the country have a concentration or a course in entrepreneurship (Wasley, 2008), in order to meet the demand for entrepreneurship skills, the bulk are schools of business or engineering, not schools of computer science. Few schools of computer science have entrepreneurship in computing programs (Gates, 2010), a concern

for which the paper furnishes a Technology Entrepreneurship program.

2. INTRODUCTION

The Seidenberg School of Computer Science and Information Systems of Pace University is beginning a concentration in Technology Entrepreneurship in its Bachelor of Arts in Computer Science program. The concentration is designed for students to learn the practice and theory of skills needed to be business opportunists, and not mere scientists or technologists. The emphasis of the concentration is on the development of cutting edge ideas for marketable processes, products or services, or seedlings, infused by entrepreneurial innovation if not invention of computational or informational technologies, in a pseudo business firm, or if feasible in an actual firm. The focus of the current model program is in learning the disciplinary domain of the practices of financial firms on Wall Street in New York City, inasmuch as the industry expends more on information technology than other industries (The Economist, 2009). New York City is also a hotbed of innovation rivaling the Silicon Valley. Further focus is in inherently learning financial skills frequently lacking in computer science students (McEachern, 2008). Moreover, the program may be replicated to further industry domains. The concentration in Technology Entrepreneurship is essentially a fusion of entrepreneurship, interdisciplinarity, and technology, on a project for a pseudo business firm.

The generic learning steps of the concentration in Technology Entrepreneurship are below for computer science majors (*):

- Define an idea for a business opportunity in a process, product or service that might be further infused by technologies or invention of new technologies;
- Design and develop a process, product or service, or prototype of a process, product or service, in a manner of creativity and innovation that furnishes competitive edge in business opportunity, by integration or invention of solution technologies;
- Design and develop a business plan for communicating the process, product or service, infused by technologies, and the potential for profitability, as a new department of a pseudo business firm or as a new pseudo

business firm, for desired funding by potential investors; and

- Design and develop a customized plan for marketing the process, product or service, infused by the technologies, to targeted customers or firms in the marketplace and for sustaining customer or firm relationships; and
- Identify contemporary innovation in informational technologies, such as software-as-a-service (SaaS) and service-oriented architecture (SOA), which might impact the process, product or service of the new venture.

(* Finance, management science and mathematics majors may be included in the program.

The outcomes of the concentration in Technology Entrepreneurship are in the learning of analytical, business, communication, creativity and innovation skills on the project – entrepreneurship skills. The students will be learning the practices of entrepreneurship in creative-thinking and problem-solving through the practice and theory of technology learned in the Bachelor of Arts in Computer Science program. The students will be learning to be business opportunists, not mere technologists.

The concentration in Technology Entrepreneurship in the Bachelor of Arts in Computer Science program of Pace University conforms to designs in the literature. The concentration is a “condition of coherence: the blending of elements ... helps to endow [skills] with meaningful connections and greater unity” (Nissani, 1995). Industry demands students skilled in practice and theory (Berryman and Bailey, 1992 & Olssen and Peters, 2005). In the concentration in Technology Entrepreneurship in the Seidenberg School, students will be blending the theory of technology to the practice of it, and the practice of it to the theory (Bransford, Brown, Cocking, Donovan and Pellegrino, 2000). In this concentration of entrepreneurship and interdisciplinarity, students will be inevitably learning to be self-motivated thinkers (Bradbeer, 1999).

3. FOCUS

The concentration in Technology Entrepreneurship in the domain of the financial industry is focused on the below courses of specific study:

Entrepreneurship and Financial Computing, a domain course integrating algorithmic com-

puting, computer science (e.g. C/C++, Java or Matlab), entrepreneurship, finance and financial analysis (e.g. derivatives products) in a project for financial decision-making;

- Entrepreneurship and Technology, a concept course integrating computer science and entrepreneurship in a project for business decision-making;
- Customer Relationship Management (CRM) and Entrepreneurship, a concept course integrating customized marketing and data mining in a project for decision-making on strategy;
- Modeling of Financial Processes, Products and Services through Technologies, a domain course integrating computer science, finance and information systems in projects for decision-making on implementation of prototyped or real software technologies; and
- Special Topics in 21st Technologies and Ventures, a survey course integrating bleeding if not leading edge marketplace technologies that might impact new ventures.

Given the 2008- 2009 Crisis on Wall Street, the concentration in Technology Entrepreneurship integrates risk management methods that might lessen misuse of processes, products or technologies that was evident in the lack of integrated monitoring of mortgage-backed securities (Roderer, 2009). This concentration in Technology Entrepreneurship in the domain of the financial industry is current in focusing on the practice of specific skills needed for students to be business entrepreneurs or opportunists, instead of focusing on a generic study or theory of entrepreneurship (Gates, 2010).

4. METHOD

The Seidenberg School of Computer Science and Information Systems is anticipating beginning the Technology Entrepreneurship concentration in its Bachelor of Arts in Computer Science program of the university in 2011. *Entrepreneurship and Technology* is expected to be the first course in spring 2011. *Entrepreneurship and Financial Computing* and *Customer Relationship Management (CRM) and Entrepreneurship* are expected to follow *Entrepreneurship and Technology* in summer 1 and 2 of 2011, and *Modeling of Financial Processes, Products and Services through Technologies* and *Special Topics in 21st Century Technologies and Ventures* are expected

to follow *Customer Relationship Management (CRM) and Entrepreneurship* and *Entrepreneurship and Financial Computing* in fall 2011. Focus is expected to be expanded from the domain of the financial industry into the health industry in *Entrepreneurial Health Informatics* courses in spring 2012, in the energy industry in *Energy Efficiency Entrepreneurship* courses in 2013, and in the security industry in *Entrepreneurship and National Security* courses in 2014-2015, as depicted in Figure 1 in the Appendix.

Students majoring in computer science or information systems may be fast tracked through the concentration, so that they finish the concentration sooner than other undergraduate students of the university that might be in the program.

5. MODEL PROGRAM

The concentration in Technology Entrepreneurship is depicted in the design of the concept course, *Entrepreneurship and Technology*, essentially an entry course, in Table 1 in the Appendix, as an example of the program.

(The designs of the other courses of the concentration are in finalization by the authors of the paper.)

The deliverable of the *Entrepreneurship and Technology* course is to be a competition for the best of projects for new pseudo prototype ventures, if not real seedlings or solution ventures, with technologies. The projects for the ventures are to be developed in incubating small (3-5) student teams, which are to be mentored by enterprise experts from the Service Corps of Retired Executives (SCORE) of New York City and the MIT Enterprise Forum, both of which have furnished executives retired from industry on other programs in Pace University. The teams are to also be mentored by the instructors of the course, who are the authors of this paper. Instructors, mentors and students are to be frequently interacting in discussion forums of the Blackboard Academic e-Education Suite of the university, if not in meetings, as the students proceed on the projects. Executives may be guest lecturers on lessons learned in industry. The best of the ventures is to be decided by a mentor panel on the 14th week.

Zimmerer, T. and Scarborough, N. (2002), *Essentials of Entrepreneurship and Small Business Management*, Prentice Hall, is to be the foundational text of *Entrepreneurship and Technology*.

(The pedagogy of *Entrepreneurship and Technology* is akin to the other courses of the concentration.)

6. IMPLICATIONS

"Entrepreneurship is critical to understanding and succeeding in the contemporary global economy." (Charney and Libecap, 2000)

The concentration in Technology Entrepreneurship in the curricula of the Seidenberg School of Computer Science and Information Systems enables an experiential foundation for computer science majors to be learning skills to be business entrepreneurs and opportunists, instead of pure technologists. Feasibility of employment and features of entrepreneurship and interdisciplinarity in the concentration may entice non-computer science students into the Bachelor of Arts in Computer Science program of the school, including female and minority students that are underrepresented in the field. Few schools of computer science and information systems have entrepreneurship and interdisciplinarity that might be marketable to a larger number of undergraduate and graduate students.

The concentration in Technology Entrepreneurship in the Seidenberg School may enable growth of students that hope to be marketable in firms. They may not hope to be entrepreneurs, opportunists or technologists, but merely marketable as professionals in industry. The concentration in Technology Entrepreneurship is enviable in the extent of learning non-technical and technical skills that might be leveraged by students.

Finally, this concentration in Technology Entrepreneurship may enable future growth in schools of computer science that furnish learning of entrepreneurship skills. Firms in industry have indicated frustration in the lack of local entrepreneurship skills and in the lower investment in computer science and information systems programs in schools in the United States (Miller, 2010). Literature is indicating that firms may be increasing investment in entrepreneurship and partnerships (Field, 2009 & Schumpeter, 2009), so that it may be an incentive for schools of computer science to be increasing investment in entrepreneurship skills of students who might be needed by industry ventures.

7. LIMITATIONS AND OPPORTUNITIES

Empirical evaluation of the Technology Entrepreneurship concentration in the Bachelor of Arts

in Computer Science program may not be finished earlier than 2012. Full inclusion of students will not be fulfilled until then. However, the authors of this essentially research-in-progress paper will be evaluating the learning outcomes of the concentration by Likert measurement of the perceptions of the students and by the performance of the students, as they finish the courses each semester into 2012. Enterprise experts in the financial industry in 2011, and in the health industry in 2012, including mentors of the student teams, will be evaluating the program from perceptions of the results of the teams. From the evaluation results in the semesters, the authors will be improving the concentration in Technology Entrepreneurship in subsequent semesters.

8. CONCLUSION

The paper defines a concentration in Technology Entrepreneurship in the Bachelor of Arts in Computer Science in the curricula of a leading school of computer science and information systems in the country. The concentration describes features of entrepreneurship and interdisciplinarity that may benefit computer science majors and non-computer science majors in marketability of skills. Though the concentration is focused in the financial industry in 2011, the health industry is to be included in 2012, and other industries will be included thereafter. The paper included a syllabus of *Entrepreneurship and Technology* to be introduced in the spring 2012 semester, but syllabi of the other courses in the concentration in Technology Entrepreneurship will be included in a new paper to be presented in 2011. The paper will benefit educators in other schools of computer science and information systems or even schools of business that are improving curricula to be current with the demands of industry.

9. REFERENCES

- Berryman, S., & Bailey, T. (1992). *The Double Helix of Education and the Economy*. Institute on Education and the Economy of Teachers College, Columbia University, New York, New York.
- Bradbeer, J. (1999). Barriers to interdisciplinarity: Disciplinary discourses and student learning. *Journal of Geography in Higher Education*, 23(3), 381-396.

- Bransford, J., Brown, A., Cocking, R., Donovan, M., & Pellegrino, J. (2000). How people learn: Brain, mind, experience, and school. National Academy Press, Washington, D.C.
- Charney, A., & Libecap, G. (2000). Impact of Entrepreneurship on Education. Kauffman Center for Entrepreneurship.
- Field, A. (2009). Business incubators are growing up: They are broadening their reach to include more tech-savvy, time-pressed entrepreneurs. *Business Week*, November 16, 076.
- Gates, A.Q. (2010). Discovery, innovation and creativity: The core of computing. *IEEE Computer*, February, 98-100.
- McEachern, C. (2008). What makes a good quant?: Quantitative analysts are in high demand on Wall Street, and universities are adapting their programs specifically to meet the financial markets' needs. *Advanced Trading*, August, 30-35.
- Miller, C.C. (2010). Fearful the US is slipping, a \$3.5 billion effort aims to help tech startups. *The New York Times*, February 24, B2.
- Nissani, M. (1995). Fruits, salads, and smoothies: A working definition of interdisciplinarity. *Journal of Educational Thought*, 29(2), 121-128.
- Olssen, M, & Peters, M. (2005). Neoliberalism, higher education and the knowledge economy: From the free market to knowledge capitalism. *Journal of Education Policy*, 20(3), 313-345.
- Rodier, M. (2009). Risk management for risky times: Real-time risk management systems and a culture of accountability are necessary to help financial firms avoid the pitfalls that caused the financial crisis. *Wall Street and Technology*, March/April, 22-23.
- Schumpeter (2009). Fish out of water: Policymakers are turning their minds to the tricky subject of promoting entrepreneurship. *The Economist*, October 31, 78.
- Shaff, G.R. (2009). Considering adding an entrepreneurship course to your curriculum? Consider this. *Proceedings of the 2009 Southeastern INFORMS Conference*, October 1-2, 999.
- Silo but deadly: Messy IT systems are a neglected aspect of the financial crisis. (2009) *The Economist*, December 5, 83-84.
- Wasley, P. (2008). Entrepreneurship 101: Not just for business school anymore. *The Chronicle of Higher Education*, June 20.

Appendix

Figure 1: Bachelor of Arts in Computer Science – Concentration in Technology Entrepreneurship 2011 – 2015*

Courses	Disciplinary Domains				
	Industry				
	Financial	Health	Energy	Security	Technology
Spring, Summer (2) and Fall 2011					
<i>Entrepreneurship and Financial Computing (*)</i>	_____	_____	_____	_____	_____
<i>Entrepreneurship and Technology</i>					_____
<i>Customer Relationship Management (CRM) and Entrepreneurship</i>	_____	_____	_____	_____	_____
<i>Modeling of Financial Processes, Products and Services through Technologies (*)</i>	_____	_____	_____	_____	_____
<i>Special Topics in 21st Century Technologies and Ventures</i>					_____

(*) *Entrepreneurial Health Informatics* in 2012, *Energy Efficiency Entrepreneurship* in 2013, and *Entrepreneurship and National Security* in 2014-2015

Table 1: Bachelor of Arts in Computer Science – Concentration in Technology Entrepreneurship**Course:** *Entrepreneurship and Technology*

Week	Topic
1	Technology Entrepreneur, Capitalism and Opportunity: Innovation and Technology
2	Technology Entrepreneur, Capitalism and Opportunity: New Venture Story
3	Competitive Edge Strategy: Venture Strategy
4	Draft of Project for Venture – Preliminary Presentation and Submission
5	Innovation Strategies: New Technology Ventures
6	Risk and Return; Case Study
7	Venture Planning
8	Venture Planning: Intellectual Property; Case Study
9	Enterprise 2.0: Knowledge Management in Venture Planning; Project for Venture – Presentation and Submission
10	Marketing Planning, Research and Sales
11	Financial Planning: Profitability of Venture; Case Study
12	Financial Sourcing of Venture
13	Regulation of Ventures
14	Project for Venture – Final Presentation and Submission