AC 2007-1376: INTEGRATING ENTREPRENEURSHIP INTO AN ALREADY AMBITIOUS CURRICULA THROUGH A COLLABORATION OF BUSINESS AND ENGINEERING PROGRAMS

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Integrating Entrepreneurship into Already Ambitious Curricula through a Collaboration of Business and Engineering Programs

Abstract

Since October 2005, the business and engineering faculties of the Milwaukee School of Engineering (MSOE) have been working on a novel effort to integrate entrepreneurship into the engineering curricula. Our methods bring together business and engineering students, two groups that normally do not interact in their course of study, to work together on a team design project. The challenge is to introduce entrepreneurship education without significantly increasing the workload on faculty and students. With the help of a grant from the *Kern Entrepreneurship Education Network* (KEEN) and the *National Collegiate Inventors and Innovators Alliance* (NCIIA), MSOE will offer entrepreneurship education to engineering students by formally integrating business topics into already ambitious business and engineering programs. In this paper, we present the joint findings and progress of the engineering college and the business school to develop an entrepreneurial spirit on our campus.

Background

MSOE is a small private university predominantly focused on engineering. Before 2005, the idea of teaching entrepreneurship was virtually non-existent in our undergraduate programs. In spring 2006, MSOE was awarded a grant by the *Kern Entrepreneurship Education Network* (KEEN) and the *National Collegiate Inventors and Innovators Alliance* (NCIIA), with a broad mandate to undertake a first-time effort to instill the ideas of entrepreneurship in the minds of our faculty and students. Faced with the challenge of integrating entrepreneurship into an already ambitious engineering curriculum, we decided to focus our resources on activities that would bring together business and engineering students, two groups that normally do not interact in their course of study, to work together on a design project.

Challenges

While there is agreement around campus that a focus on entrepreneurship is both a timely and a worthy undertaking, there are significant obstacles to be overcome in order to achieve our goal. The business and engineering programs have completely separate curricula, completely separate faculty that rarely have reason to interact, and that are physically located in separate buildings on opposite ends of the campus. The academic content of our programs is already quite ambitious (as is the case at every other ABET-accredited institution). Finding room for new content is always difficult. Students do not want to be required to take more courses. Faculty members are reluctant to crowd more content into their existing courses. Publicly supported universities in our area have more resources to devote to entrepreneurship. Our two nearest competitors are state-run universities that have each received multi-million dollar grants for entrepreneurship education. In contrast, we are just getting started on our endeavor to introduce entrepreneurship education and to ultimately make it a permanent part of our curriculum.

In summary, here are the main challenges to our efforts:

CHALLENGES TO INSTILLING ENTREPRENEURSHIP EDUCATION AT MSOE
1. How to achieve our main goal of getting the schools of business and engineering to work together as peers in an effort to promote entrepreneurship.
2. How to encourage faculty to take on the new task of teaching entrepreneurship when they are already handling a heavy workload.
3. How to get students excited about entrepreneurship when they already face an ambitious and challenging curriculum.
4. How to accomplish the above goals on a modest budget in a short timeframe.

Our response to these challenges is described in the following sections that list the activities that have been initiated in the past year and that are now underway at MSOE.

Faculty Orientation (addresses challenge #2)

Every year, just prior to the start of classes, a series of seminar-style "in-service" sessions are held on campus to inform faculty of new or modified programs or procedures. In fall 2006, we organized and held a half-day session that introduced the key elements of entrepreneurship to the faculty. The half-day sessions were well attended and an inventory-style survey was conducted at both the start and end of the session, which provided evidence of its success. The details of the faculty seminar on entrepreneurship and a reporting of the results are addressed in another paper submitted to this conference[1].

Pilot Program (addresses challenges #1 through #4)

Realizing that it would be too large an undertaking to introduce entrepreneurship across all programs, we decided to focus on one engineering program in order to develop a template for the others. Biomedical Engineering (BE) was chosen as the pilot program because of the strong emphasis on integrating engineering design projects into multiple years of the curriculum. Virtually each term of the BE program has at least one design course that emphasizes innovation and design in solving problems. It has a 10-course[2] design sequence that starts in the freshman year and culminates in a capstone design project in the final year of study. This course design, combined with a willing faculty, made BE an easy choice for our initial effort.

In order to make effective use of university resources and have an immediate impact on the BE curriculum, the plan for teaching entrepreneurship was to break up the topics into educational modules which each focusing on one particular aspect of business. This modular approach allows existing content from business courses to be used as new content in the engineering courses, thus addressing the faculty workload issue (challenge #2). Modules are being

[1] John D. Gassert, et. al., "Converting Engineering Faculty to Educators of Entrepreneurs" to be presented at the 2007 ASEE Annual Conference.

[2] MSOE uses 11-week quarters rather than the typical 16-week semesters in all its academic programs. There are 3 quarters in the academic year from September through May, and an optional summer quarter.

developed to teach topics including: business planning, intellectual property, venture capital and angel investing, marketing, finance and business law. Each module contains a presentation of content and an assessment of how well the material was received. Modules can be developed by both engineering and business school professors and are typically taught by the business faculty member. The faculty member that presents the module also administers the assessment in order to measure student performance on the module against its stated objective. Having business faculty teach the topics of the entrepreneurship modules in the engineering courses makes efficient use of instructor time and knowledge (challenge #4).

The benefits of using this modular approach to teach entrepreneurship in our curricula for the very first time are many. Our desire was to gradually introduce the topic; but to do it in a way that would have some permanence in the curriculum, rather than just doing something that would last only for the period of the grant. While the ultimate goal is to add new elective courses that focus solely on entrepreneurship, the modular approach avoids the difficulties of establishing new courses that are subject to the long process of curriculum committee review and approval, compensation costs for faculty development of the new courses and student resistance to additional coursework. The modular approach also allows for the insertion of entrepreneurship education into existing courses where it would be the most relevant and appropriate. This will expose far more students to entrepreneurial concepts than would a stand-alone elective course. Many students are unfamiliar with the notion of entrepreneurship and thus would not consider taking such an elective. Introducing the topic in existing courses, however, allows a wider audience to be introduced to entrepreneurial concepts and will spark interest in pursuing further study of the topic, thus creating more demand for our newly developed electives.

Entrepreneurship Courses (addresses challenge #3)

In addition to the modules developed for the BE curriculum, the business school recently developed three one-credit elective courses on entrepreneurship. The courses provide more depth into the topics of the business plan, entrepreneurial finance and development of a marketing strategy. The courses are limited to just one hour per week, which makes them less intimidating and more attractive to students than the traditional three-credit course (addressing challenge #3). In addition, these courses are scheduled late in the afternoon so that both day students and evening students have the opportunity to attend. This further extends the reach of our entrepreneurial courses beyond the traditional day students to a population of primarily working professionals. Table 1 summarizes the topics covered in the entrepreneurship courses.

Table 1 - Courses in Entrepreneurship (1-credit each)

COURSE	TITLE	TOPICS
MS-3425	Entrepreneurship I	Overview, Finding a Market for Your Ideas
MS-3427	Entrepreneurship II	Developing the Business Plan
MS-3429	Entrepreneurship III	Financing the Venture

Enrollment data indicates that students are finding the time to take these courses, even though they are not required in their degree programs, thus indicating that our modular approach is generating some success. Table 2 shows the enrollment data for the past two years.

Table 2 – Enrollment data for the Entrepreneurship courses

COURSE	FALL, 2005	FALL, 2006	WINTER, 2005	WINTER, 2006
Entrepreneurship I	12	17	6	11
Entrepreneurship II			8	16

Entrepreneurship III was offered for the first time in spring 2006 and attracted eleven students. It will be offered again in the spring 2007. At that time we will have the enrollment data to know if it too has experienced increasing enrollment.

NCIIA E-Team Grants (addresses challenges #1 and #3)

At MSOE, as at most universities, the business and engineering programs are completely separate. They have separate curricula, faculty and facilities. To address challenge (#1) to foster cooperation between business and engineering students and to create an incentive to work together, we created a new collaboration of twelve business students with twenty-four biomedical engineering students on four teams. Their joint project is to write four separate proposals to the National Collegiate Inventors and Innovators Alliance (NCIIA). The grants are part of the NCIIA E-Teams program, where interdisciplinary teams of college students are encouraged to submit the business plans for their new inventions. This was accomplished by assigning one business team (consisting of two or three business students) to one engineering team (consisting of five or six BE students) and by having a business faculty advisor and engineering faculty advisor assigned to each team. The engineering students are responsible for creating an innovative product and the business students are responsible for developing the business plan to market, finance and develop the business strategy.

In order to motivate students and faculty to participate on these E-Teams, we needed to create some incentives. The business students were given independent study credit for their work on the business plan, the engineering students were already receiving credit for their senior design engineering course but were now given help to reach their goals, and the faculty members from both schools received compensation for their advisory roles as part of their evaluated workload. In short, everyone was being compensated in some fashion for their contribution to the project. Team meetings were held during the lab time scheduled for the engineering design class so that no extra class time was required. Students also met outside of class time to write their project documents and to meet with their advisors.

Two of the team proposals were submitted in December, 2006 and the remaining two team proposals will be submitted in the May, 2007 call for proposals. Since the NCIIA proposals are structured and detailed (involving market analysis, schedules and budgets) this gave clarity of purpose to the interdisciplinary teams, benefiting each team by helping business students to understand engineering designs and helping engineering students to understand the elements of a

business plan (challenge #1). Having the opportunity to receive grant money for their proposals raised the excitement level among the students, and gave them encouragement to take on this additional work, thus addressing challenge #3.

Entrepreneurs Club (addresses challenge #1, #3 and #4)

The formation of a new Entrepreneurs Club was viewed as an activity that would extend our message of entrepreneurship education to the entire student population. We decided that the business school was the appropriate place to start an Entrepreneurs Club. It initially required one faculty member's time to organize meetings, find speakers, recruit Club members and promote Club activities with the eventual goal of turning over the leadership of the Club to students.

A student-led Entrepreneurs Club was formed in September, 2006, and held five meetings over the fall quarter. Each meeting featured an invited speaker to present a topic of general interest to the members. The topics for the fall 2006 quarter are shown in Table 3 below. It was possible to find quality speakers to volunteer their time to present their topics to our student audience.

Table 3 – Topics presented by speakers at Entrepreneurs Club meetings

#	DATE	SPEAKER	TOPIC
1	22-Sep-2006	Dr. Jeffrey Blessing, Kern Fellow	Kickoff & Overview
2	16-Oct-2006	John Calvert, Patent Examiner, U.S. Patent & Trademark Office	Patents, Trademarks and Intellectual Property
3	27-Oct-2006	Gene Wright, MSOE Alumnus	"The Art of the Start" and Lux Innovations, LLC
4	10-Nov-2006	G. Woodrow Adkins, Uihlein/Spitzer Chair for Entrepreneurship	Venture Capital, Angel Investing, Bootstrapping, Investment Trusts and other Venture Financing
5	1-Dec-2006	Steve Radlinger, Entrepreneur	Offered equity positions in startups to qualified software developers in the student body

The formation of the Club served to address many of our intended goals and in some cases, exceeded our expectations. The benefits realized through the activities of the Club include:

1. Although formation of the Club required the efforts of one faculty member, our vision for the Club is that it will become an autonomous, student-run organization. The club idea was attractive because it parallels in many ways the problems associated with the start-up and operation of a real business. For example, students had to find customers (by recruiting members), develop a product or service (hold events, find speakers, etc.), advertise and market (promote Club activities) and budget and track expenses. Thus, students gained experience in some of the basic elements of entrepreneurship.

2. The cost of formation and operation of the Club is quite low. We were pleasantly surprised to find high-quality speakers who were willing to donate their time and expertise. Advertising was done, at almost no cost (addressing challenge #4), through existing e-mail lists and a newly created web site for the Club (described in the following section).

3. No faculty member time was required beyond the initial effort of the Kern Fellow. Occasional advising by a faculty member is all that is anticipated for the future (addresses challenge #2).

4. The Club places no additional course load on the students. Membership is voluntary. Students have no homework, tests, grades or pressure to perform academically; but are learning in an entirely self-motivated environment, outside of the usual restrictions of a formal course (addresses challenge #3).

5. The Club provides a way to introduce concepts and ideas that would not otherwise be presented in the university curriculum. (For example, inspirational stories presented by real-world business owners provide an insight that faculty cannot match.)

6. To our surprise, academic and administrative staff members and even other faculty contacted the Club's faculty advisor to inquire about becoming members of the Club. Word of the Club's activities also spread beyond the university to recent graduates who were in the process of starting their own businesses and wanted to join in the efforts of our Club.

Marketing Entrepreneurship Efforts (addresses challenge #3 and #4)

Marketing a new organization on campus can be quite a challenge. Currently there are over fifty student clubs and organizations on campus. The competition among student groups to reach their audience and get their message out to the university community has lead to the formation of electronic mailing lists just for student groups. By making use of the mailing lists to promote the Entrepreneurs Club events, promotional costs were driven to zero. The only cost associated with promoting our Club's events is the time it takes the author to compose an informative, eye-catching e-mail message.

Supporting the local community of entrepreneurs is quite another challenge. Much of entrepreneurship (and business) is about networking. Yet most of the group members don't have the time or ability to effectively network outside of Club meetings. The challenge is to find a networking forum that doesn't require much effort on the part of the student. To address this need, a community-based web site dedicated to entrepreneurship (http://eship.msoe.edu) was created using open-source software. The web site has become the university's central bulletin board for the entrepreneurial activities happening within our community. The web site also allows any user to read articles and browse the site's contents. If the user wishes to post content, all they need to do is register for an account on the site. It allows users to post stories and pictures, keep a running web log ("blog") and comment on any other content that is posted on the site. The cost of running the site is also near zero. The server was loaned to the group by the

campus computing center. The software is free and open-source. The only ongoing expense is the time required by the system administrator to install, deploy and otherwise configure and care for the software running on the server. Currently the faculty advisor for the Club is also functioning as the system administrator. Training is underway to eventually turn this job over to the students in the Club, thus eliminating our only ongoing expense. The Club's web site currently has 65 registered users and dozens of postings related to entrepreneurship.

CEO Conference (addresses challenge #1, #3 and #4)

We anticipated that one of the major expenditures on entrepreneurship would be to send seven students from the Entrepreneurs Club and their faculty advisor to the National Collegiate Entrepreneurs Organization (CEO) conference in Chicago, Illinois. The total cost of attending the conference was approximately $4,000. We were delighted to find that the Club was able to secure three grants to cover the entire expense of the trip. Thus, one of the largest anticipated costs of our entrepreneurial project turned out to be almost zero (addressing challenge #4). The funding sources for the CEO conference are summarized in Table 4 below.

Table 4 - Grants Received for CEO Conference

AMOUNT	SOURCE
$250	Illinois Institute of Technology (conference co-sponsor)
$1,000	Coleman Foundation (conference sponsor)
$2,750	MSOE Uihlein-Spitzer Center for Entrepreneurship

Student feedback on the conference was quite positive. The average rating for the overall conference was 8.5 out of 10. Each student had to submit a 3-page paper critiquing the sessions they attended. These papers were also submitted to the respective funding sources in order to document the results of the trip. All of the students indicated that they want to attend next year's CEO conference and several had developed ideas to make their attendance more effective and rewarding. (For instance, some students plan on creating their own business cards to distribute at the conference.) The overall conference ratings given by the students are shown in Table 5 below.

Table 5 - Student Rating of CEO Conference

STUDENT	OVERALL RATING
1	10
2	8
3	7.5
4	10
5	5
6	10
7	9

An informal survey of the students after the conference revealed that three had started forming plans to run a business while they were still in school. One had definite plans to start a business after graduation, and three came away with new ideas to help our Club grow. As a result of our involvement with the conference, all seven students were motivated to put to use ideas that were generated at the conference.

An unexpected benefit that emerged from our group travel was the camaraderie and friendship that resulted from the shared experience of attending the conference. One student wrote:

> "I learned that our advisor … has a deep passion to really take this Entrepreneurs Club to the next level and that he has chosen a great surrounding team to help him get there. Our group of students included some very interesting and educated individuals that I feel honored to go to school with. The insight, personal experiences and youthful determination that was present at the conference just reassured me that this is my calling in life."

While at the conference, our student group met with students from the entrepreneurship club of IIT, our closest neighboring university in the KEEN grant community. The students, with the help of faculty advisors, visited each other's campus during February, 2007. This unexpected collaboration has increased student interest in our Club's activities, thus helping to address challenge #3.

Chicago Entrepreneurs Quest (addresses challenge #1 and #3)

While attending the CEO conference, several of our students had time to get to know students from other KEEN schools. One of the KEEN schools closest to MSOE is the Illinois Institute of Technology (IIT). Our students informally met with IIT students at the Science and Engineering sessions of the CEO conference and started to plan collaborative events. Since MSOE is new to entrepreneurship and IIT has well-established entrepreneurship programs, we felt that we could learn a lot from our colleagues. One of the topics discussed in these sessions was the idea of a Chicago Entrepreneurs Quest, which grew to become one of the major activities of IIT under their KEEN grant.

The Chicago Entrepreneurs Quest can best be described as a one-day entrepreneurship-based competition that is part "scavenger hunt", part "The Apprentice" and part "Lost". Forty students in eight teams from four universities spent the day tracking down clues and materials in Chicago's "loop" business district, building prototypes, defending their design decisions and pitching their business cases to area executives; all in a pursuit to design the next-generation cell phone for Motorola. The four participating universities in the first Chicago Entrepreneurs Quest were the Illinois Institute of Technology, DePaul University, the University of Illinois at Chicago and the Milwaukee School of Engineering. It is anticipated that the Quest will become an annual event for IIT, the event organizer. For more information, pictures and video on the Chicago Entrepreneurs Quest, visit the official website at www.iit.edu/~ceq.

MSOE entered two teams for the Quest; one consisting of two business students and three engineering students and the other consisting of three business students and two engineering students (thus addressing challenge #1). The MSOE team of three business students and two engineering students did quite well, finishing the competition in second place and winning a one thousand dollar cash prize (thus addressing challenge #3).

Business Opportunity (BizOp) Competition (addresses challenge #3 and #4)

The Entrepreneurs Club is also organizing a Business Opportunity (BizOp) competition in which students compete for prize money based on the best startup businesses that are demonstrated using online business simulation software. Originally the idea was to use CapSim or GoVenture or one of the many business simulation software environments. Instead, the students found a unique forum for experimentation with entrepreneurship. The platform chosen by the students for the competition is the virtual reality world "Second Life" (www.secondlife.com). Users interact in a web-based virtual reality "game" by operating an avatar (virtual person) as they explore the many facets of the online world. There is much opportunity for entrepreneurship in Second Life. Items can be created and sold in the virtual world using a unit of currency called the Linden dollar. The simulation becomes real when one finds that virtual currency exchange businesses operate in Second Life. The current exchange rate is approximately 275 Linden dollars to one US dollar. There are about $1 million (US dollars) transacted in Second Life every day. It has a registered user list of over 2.3 million people. At any one time, there are approximately 20,000 users online in the virtual world.

Our students are investigating the use of Second Life as an elaborate simulation environment for entrepreneurship. Having the "human factor" of a real person behind every avatar makes the simulation much more like the real world. Our investigation with Second Life continues and we will report our findings at the end of the school year. The presence of Second Life has helped us address challenge #3 and #4.

Senior Design Competition (addresses challenge #2 and #3)

At our university, all engineering programs have a capstone senior design course sequence in which student teams analyze a problem domain, then design, implement and test a solution to their problem. The year-long effort culminates in a design show (much like a trade show) where teams set up booths to demonstrate their prototypes and inventions. Since this is the most visible effort of innovation among our students, the KEEN team has decided to initiate a competition and award prizes to the top three teams, as selected by an independent board of outside experts. Judges will be chosen from the Alumni Office on campus, who will solicit volunteers from their contacts (mostly graduates and others from local industry). Prize money for the competition currently stands at $1,500 for first place; $1,000 for second place; two $500 awards for third place; and two $250 awards for honorable mention teams. This effort is meant to directly address challenge #3, how to get students excited about entrepreneurship. The results of the senior design competition will become known in May, 2007.

Conclusion

While our initial foray into entrepreneurship appeared daunting at the start, we were able to find creative ways to address all the challenges we faced. Through the efforts of faculty and students over the past school year, entrepreneurship is now an important part of the educational offerings at our university. It has found a home in one engineering curriculum and is positioned to be integrated into more engineering degree programs. It has also found a home in the school of business through the creation of entrepreneurship courses and educational modules that can be added to existing courses. Perhaps most importantly, it has found a home in the everyday life of students, faculty, and staff at the university through the formation of an Entrepreneurs Club that seeks to support the hopes and dreams of its members. Yet, this is only the beginning of what we hope to accomplish through entrepreneurship on our campus. A newfound focus on entrepreneurship as a catalyst for innovation has now been established. The initial effort on entrepreneurship started by the KEEN grant will be sustained by the recently founded offices of the Center for Entrepreneurship at MSOE.

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