MEMORANDUM

TO: Professor Cohen
FROM: Mike Gadigian, Chris Schellens & Colin Tofel
SUBJECT: Entrepreneurship Minor Proposal
DATE: May 9, 2013

OVERVIEW AND RESEARCH QUESTION:

      For the semester project, our group has developed an Entrepreneurship program for Lafayette College. This program, which is in the form of a minor, is available for students of all majors and will coincide with the goals of the proposed Center for Innovation, Design, Entrepreneurship, and Leadership (IDEAL Center). The minor consists of six courses that convey the key principles of entrepreneurship. Entrepreneurship is identified in the professional world as the conversion of innovative thinking into successful economic enterprises. Entrepreneurs generally develop innovative products or ideas in order to create small businesses. By designing an entrepreneurship curriculum, we hope to provide Lafayette students with the opportunity to both understand and work in this field. With the growing importance of entrepreneurship and small business in the professional world, it is becoming increasingly important for graduates to either possess or understand fundamental entrepreneurial skills in order to succeed in the future. In recent times, small businesses and startups have been rising in significance. According to the Small Business & Entrepreneurship Council, small businesses accounted for 48% of US non-farm GDP as of 2008, and small businesses were responsible for 65% of US job creation over the past twenty years. By conducting research and speaking with experienced individuals, our group worked to address the question of whether or not the availability of an Entrepreneurship program for students at Lafayette College would be beneficial for students as they move into the professional world. By designing an Entrepreneurship minor, we worked to provide students with the financial, business, marketing and policy principles necessary to start a career in entrepreneurship.

PURPOSE:

      Our group selected this topic due to the strong correlation between engineering and entrepreneurship as well as the strong set of professional opportunities available for entrepreneurs. As Engineering Studies majors, our group intended to identify the importance of entrepreneurship to engineers and to determine whether its principles can effectively be conveyed to engineers in an academic environment. As it currently exists, the Engineering Studies major provides students with the tools necessary to become successful in corporate and engineering roles: the critical thinking, organization skills, communication abilities, creativity, and versatility emphasized within the major are essential to success in these fields. Our group intended to broaden the set of professional opportunities available to Engineering Studies majors by supplementing their existing innovative and creative skill sets with entrepreneurial skills including business

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knowledge, decision making abilities, risk management, financing, and marketing experience.

As our project developed, we expanded the scope of our product beyond the Engineering Studies major. Through expanding the availability of the Entrepreneurship minor to students of all majors, our project objectives evolved into promoting the study of Entrepreneurship for students of all majors while also bridging the gap between the Engineering and Liberal Arts segments of Lafayette College. By working toward the successful implementation of an Entrepreneurship minor, our group pursued two main goals: providing students with the skills to understand and pursue careers in entrepreneurship, and establishing an entrepreneurial alumni base that can provide professional contacts for future students.

RESEARCH AND PROJECT CONTEXTS:

In order for our group to be able to design an Entrepreneurship minor, we conducted an extensive research procedure. We analyzed twenty-seven sources focusing on the academic, professional, social, and historical contexts of entrepreneurship. The academic and professional contexts were thoroughly discussed in eighteen peer-reviewed sources. These articles identified the key ideas of entrepreneurship, the teaching methods and program formats, and the professional opportunities that are available to entrepreneurial engineers. We were able to identify the key ideas necessary for entrepreneurship education including innovation, communication, business modeling, problem solving, marketing, policy awareness, and decision making under risk and uncertainty. These principles were stated from both the academic perspective (Duval-Couetil & Reed-Rhoads) and the professional perspective (Stillman), allowing our group to gain insight on the academic ideals and employer-desired skills associated with entrepreneurship. Other peer-reviewed sources discussed, compared, and contrasted the structures of entrepreneurship courses at various universities within United States. These institutions included Clark University, the University of Calgary, New York University, Pace University, and the University of Pennsylvania. The sources also discussed foreign entrepreneurship programs in institutions such as the Technical University of Hamburg and the University of Western Australia. By analyzing the curriculums utilized by these institutions, we were able to understand how the major principles of entrepreneurship can be encapsulated in an academic format.

We also collected nine non-peer-reviewed sources in order to understand the social context and debate centering on entrepreneurship. These sources, including N. Wasserman's "Can Entrepreneurship Be Taught?" debate the practicality of teaching entrepreneurial skills. In this article, one side states that the leadership and decision making skills necessary for entrepreneurs can be taught in an academic environment, while the other side argues that these qualities can only be developed through real-world experience. This social context displayed the difficulty of teaching entrepreneurship. The rapid change, unpredictability, and complexity of the real world call the relevance of traditional entrepreneurship programs into question. Through studying this context, our

group determined that our program must include hands-on, engaging projects and simulations that emulate real world conditions. This focus would allow our curriculum would allow students to develop a strong foundation of entrepreneurial skills and experiences without encountering material redundancies.

Our research also involved the analysis of articles outlining the historical context of entrepreneurship. Several sources illustrated that entrepreneurship has played a vital role in the evolution of society. These articles also showed that entrepreneurship and innovation are currently growing faster than ever before. In a recent Global Entrepreneurship Monitor (GEM) survey, a steady increase in total entrepreneurship activity (TEA) across numerous and varying economic levels was displayed. Our historical sources also showed the vital role that entrepreneurs have played within society's framework, with notable historical entrepreneurs including Henry Ford, Benjamin Franklin, and Thomas Edison. Through analyzing these peer-reviewed and non-peer-reviewed sources, our group was able to gain a deeper understanding of the importance of entrepreneurship, its relevance to society, the key methods to successfully conveying its principles, and the professional implications of teaching these ideas. By utilizing these sources and understanding the educational, professional, social and historical contexts, we were better able to develop an entrepreneurship program at Lafayette College.

PROJECT CONTACTS:

Our project involved close interactions with the head of the Economics department, Professor Gamber. Additionally, we contacted Wayne Barz and Dr. Peter Torrione, both of whom have experience with entrepreneurship in the professional and academic worlds. These individuals highlighted the importance of professional writing, business strategy development, and marketing as key principles necessary for successful entrepreneurship programs. They also stressed the importance of teaching corporate finance and the process raising and managing cash. We also discussed methods of curriculum development with these contacts. Professor Gamber, as well as Wayne Barz, an adjunct professor at Lafayette College, assisted our group with the aligning of course prerequisites, availabilities, and the overall goals of the minor.

In supplement to our academic contacts, we spoke with successful entrepreneurs in the professional world. Our primary contacts are Eric Straus, who played a major role in the development of Groupon, and Carl G Anderson Jr., who is a professional entrepreneur. By speaking with these contacts, we were better able to understand what factors were most important to their entrepreneurial success. By extension, these contacts will be able to critique our course contents and structure. Through speaking with these individuals, we were able to revise our program in order to prepare students for success in entrepreneurship in the best possible manner.

FINAL PRODUCT:

After our research phase, we were able to generate a draft curriculum for the entrepreneurship program. We brought this curriculum to various contacts including Wayne Barz and Professor Gamber in order to gain feedback on the feasibility of the courses, structure, and program as a whole. After undergoing a revision process, we created a final curriculum for the Entrepreneurship minor. This program appears in a course-listing format, which includes a description of the concepts and goals for each course. A complete course listing is included in item two of the Appendix. Our program is available for all students who have completed the prerequisite course, Introduction to Economics. The minor consists of six courses, three of which were designed by our group and will be required for the minor. These classes include: Introduction to Entrepreneurship, Entrepreneurship Marketing & Finance, and Capstone: Entrepreneurship and Business Development. The remaining three course requirements are satisfied by preexisting courses at Lafayette that possess entrepreneurial principles relevant to the minor. Students will be required to select three courses from the approved list of electives. Our group proposed an optional "track" system in which students could select these electives. These tracks, which include the Commercial & Business, Scientific & Technical, and Social & Humanities tracks, allows the opportunity for students of all different disciplines to supplement their knowledge from their major with the Entrepreneurship minor. Within each track are suggested electives, in which one class must be technical, and one must be writing. However, students do not have to choose a track, and can instead take the three required classes and fulfill their minor with some of the other electives we have provided.

Our course curriculum has been posted on an interactive Wordpress site. This site provides viewers with program and course information, as well as general entrepreneurship information. The site can be viewed at the following link: http://sites.lafayette.edu/egrs451-sp13-tofelc/. We posted information and quotations from our key contacts as well as links to useful resources and events. These events include guest speakers at Lafayette, details for local "Hackathons", and information regarding Startup Weekends.

FUTURE OUTLOOK:

Ultimately, we hope to present the Entrepreneurship minor as an option for Lafayette College to adopt, especially with the new IDEAL center in the works. After speaking with Professor Gamber, one of the leads on the new IDEAL Center, we realized the importance of combining our project with the center. The similarities between our Capstone: Entrepreneurship and Business and the proposed IDEAL project that all IDEAL students must take display a natural partnership between the two programs. Our group also hopes to use our experience to create and maintain relationships between our contacts and future students. One of the most important aspects of learning entrepreneurship is through hands on learning, and providing the tools and resources necessary for this is vital. This is why we hope to stay in coordination with the Ben Franklin Institute at Lehigh University. This institute, which is a start-up incubator,

provides internships to students, hosts events such as "Hackathons", and is ideal for the potential use as a source of case studies and guest speakers. A partnership with the Ben Franklin Institute would also be vital for the success of the proposed Entrepreneurship Internship course.

Through establishing an entrepreneurship minor at Lafayette College, we intend to establish an alumni employee base in small businesses in the future. Students across all majors will be able to develop entrepreneurial skills that provide them with a broader set of professional opportunities. Additionally, by aligning our minor with the IDEAL Center and its goals, our program will promote interdisciplinary work. Finally, with the wide-reaching availability of the Entrepreneurship minor, the program will successfully synthesize liberal arts, science, and engineering to address complex social and technological problems, enhance leadership skills, and promote teamwork.

Signed: _____   _____   _____
　　　　　　　Mike Gadigian　　　　　　Chris Schellens　　　　　　Colin Tofel

We have included (1) an annotated bibliography of the sources utilized in our project and (2) a complete course listing for our proposed Entrepreneurship minor program in the appendix.

APPENDICES

1) Annotated Bibliography

Arora, V. K., & Faraone, L. (2003). 21st century engineer-entrepreneur. *Antennas and Propagation Magazine, IEEE,* 45(5), 106-114.

Arora, from the Department of Engineering and Physics at Wilkes University, and Faraone, from the School of Electrical, Electronic, and Computer Engineering at The University of Western Australia, write a paper addressing how to combine technical prowess with entrepreneurship in engineering education. They also go on to discuss critical factors in the development of effective, efficient workers in the 21st century. Separating the paper into multiple parts, the authors first talk about how to combine technical knowledge with decision-making skills for an effective entrepreneur. They then talk about some of the missing aspects of entrepreneurial education and provide a curricula to solve the problem. Arora and Faraone finally talk of how leadership, management, and professional development are needed to become a visionary in the work force. This article will be a useful source because they outline, using prior knowledge, how to make an effective, efficient, 'knowledge worker' for the 21st century. The 'Final Words' section condenses the paper into a few columns in which effectively enhance the value of entrepreneurial training.

Bonnet, H, Quist, J., Hoogwater, D., Spaans, J., & Wehrmann, C. (2006, May). Teaching sustainable entrepreneurship to engineering students: The case of Delft University of Technology. *European Journal of Engineering Education*, 31 (2), 155-167.

This article discusses the development of a sustainable entrepreneurship and technology curriculum for engineers at the Delft University of Technology. This program incorporated principles from entrepreneurship, sustainability, and project education fields. The program also provided strong insight on the development of successful business plans and how to pursue these plans within clearly defined social, economic, and environmental contexts. Additionally, it emphasizes the importance of diversity and nontechnical proficiencies for engineers. While this article provides strong insight for the development of an entrepreneurship program, its usefulness is limited by its age. The article, which is over six years old, must be supplemented with modern entrepreneurship principles in order to be a relevant curriculum model for the future.

Bornstein, D. (2012). The rise of the social entrepreneur. *The New York Times.* Retrieved from http://opinionator.blogs.nytimes.com/2012/11/13/the-rise-of-social-entrepreneur/

In this article, the author discusses the recent prominence of entrepreneurship as a career path throughout the world. Entrepreneurs are presented as innovative individuals with the ability to create new solutions for social problems. By extension of this view of entrepreneurs, entrepreneurship is shown to as the major driver of future social change. The author discusses the relevant social and political developments that have allowed

entrepreneurship's rapid growth. The author discusses critical thinking and problem solving as essential qualities for entrepreneurs, which logically defines engineers as strong candidates for entrepreneurship. The information provided within this article is not peer-reviewed, however, and it should not be accepted without external verification.

Brown, P. B. (2007). The right places to learn entrepreneurship. *The New York Times*. Retrieved from http://www.nytimes.com/2007/10/30/business/30toolkit.html?_r=0.

This article, presented in a 2007 edition of the New York Times, analyzes and rates hundreds of colleges and universities around the country based on their entrepreneurial education. One of the most interesting and intriguing points from the article came from that of a Professor at Clark University who said that their program encourages students to follow whatever their passion be, but to strongly link that interest with the education of entrepreneurship so that upon graduation that student could more effectively follow and implement their dream. The point being that focus is not put upon management majors or the like, but that this educational experience is actually more aimed toward that of students in the arts and sciences. While informative and helpful in understanding what programs have succeeded most fully, the article doesn't look to delve very deeply into any of the programs. Even still, the article provides strong references for programs to emulate and learn from.

Duval-Couetil, N., Reed-Rhoads, T., & Haghghi, S. (2012). Engineering students and entrepreneurship education: Involvement, attitudes, and outcomes. *International Journal of Engineering Education*, 28 (2), 425-435.

In this article, the results of a study involving engineering students' reactions to entrepreneurship programs were presented. Initially, the article discusses typical engineer career ambitions. The majority of these engineers sought careers with medium to large scale companies. Next, students who had taken one or more entrepreneurship courses were surveyed, and these students showed a higher interest in entrepreneurial career choices. This article highlights the career opportunities that are available for engineers who are able to develop entrepeneurial skills. Entrepreneurship programs within engineering curriculums can incentivize students to pursue small business opportunities, resulting in job creation, innovation, and international competition.

Fiet, J.O. (2001). The theoretical side of teaching entrepreneurship. *Journal of Business Venturing*, 16 (1), 1-24

The topic of the article revolves around the idea of whether entrepreneurship can be taught in an effective enough manner as to truly produce entrepreneurs upon graduation. This is the first of a two part article that looks at the theoretical side of teaching entrepreneurship arguing that education needs to be more refined and taught in a way that emphasizes learning by doing. (The second article refers to the pedagogical side of entrepreneurship) The author, a professor of entrepreneurship at the Jonkoping International Business School in Sweden, argues for the increasing use of theory in educating entrepreneurial students and moreover encourages learning through a method

very similar to that of the scientific method which is used by varying scholars to dissect hypothetical outcomes about the future. Although it is a decade old, the ideas the author presents in this article provides insight into a possible methodology that could be used in a curriculum to promote entrepreneurial thinking within undergraduate students.

Giacomin, O., Janssen, F., Pruett, M., Shinnar, R.S., Llopis, F., & Toney, B. (2011). Entrepreneurial intentions, motivations, and barriers: Differences among American, Asian and European students. *International Entrepreneurship and Management Journal*, 7 (2), 219-238

In this article, the authors examine the similarities and differences between American, Asian, and European entrepreneurship educational programs. The authors point out the differences that exist across different countries in motivations, expectations, and barriers for students to launch their own entrepreneurial startups. Additionally, the differences in prioritization of these various entrepreneurship-related factors across various countries are presented. This article stresses the importance of cultural context in constructing entrepreneurship curriculums. It argues that there cannot be a uniform entrepreneurship educational system that would be successful in all countries. Despite this article's strong insight on entrepreneurship program development, it fails to mention engineering and technical knowledge, limiting its relevance to this project.

Global Entrepreneurship Monitor. (Jan. 2012). *Entrepreneurs now numbering near 400 million in 54 countries, according to GEM 2011 Global Report.* Retrieved from http://www.gemconsortium.org/news/758/entrepreneurs-now-numbering-near-400-million-in-54-countries,-according-to-gem-2011-global-report.

Kenney, M., & Patton, D. (2011). Does inventor ownership encourage university research-derived entrepreneurship? A six university comparison. *Research Policy,* 40 (8), 1100-1112.

This article analyzes the effect of universities allowing invention ownership on the number of spin-offs generated by the institutions. The authors argue that the analyzed North American universities with inventor ownership rather than university ownership produce a greater number of spin-offs. The author then breaks down the most successful fields of study in producing these types of businesses: computer and electrical engineering create the most spin-offs, followed by biomedical sciences, engineering, and physical sciences. This article provides an interesting perspective on the relationship between universities, engineering, and entrepreneurship. Through promoting inventor ownership, students possess more incentive to be innovative.

Loh, K. (2012). Engineering entrepreneurship minor: A history. *The Daily Pennsylvanian*. Retrieved from http://www.thedp.com/article/2012/04/engineering_entrepreneurship_minor_a_history

Loh, a staff member at The Daily Pennsylvanian, talks about the history of the engineering entrepreneurship minor, which for the University of Pennsylvania is specifically based off similar programs at Stanford. She talks about some of the specifics of the minor, including core curricula, Engineering Entrepreneurship 1 and 2, which gained much popularity within the school, necessitating the formation of a minor of entrepreneurship. The Program Director, Thomas Cassel, states that engineering education in entrepreneurship is different from business education in that engineers have to come up with an idea, create the venture, and execute the idea, hiring the business majors and professionals to help them run their new start-up. The University of Pennsylvania hopes that the minor is providing the educational framework to understand how companies succeed, and the realities of attempting to start one's own business. This article is useful because it shows how very recently, other schools have realized the need and opportunity for curricula change to incorporate engineering entrepreneurship. By looking at the curriculum and the goals of the minor, we can more effectively look at how to structure our proposed curricula.

Lüthje, C., & Franke, N. (2003). The 'making' of an entrepreneur: Testing a model of entrepreneurial intent among engineering students at MIT. *R&D Management*, 33(2), 135-147.

This article surveys about 500 MIT School of Engineering students to test a model on entrepreneurial intent. Lüthje, part of the Institute of Technology and Innovation management at the Technical University of Hamburg, and Franke, at the Department of Entrepreneurship and Innovation at Vienna University of Economics and Business Administration, try to find a link between students' attitudes towards entrepreneurship, and how policy makers and universities should be presenting entrepreneurial education. The results show that by laying down a fundamental context for which entrepreneurship is based, students will adapt to a new ideal of what starting a business means in today's society. The research shows that perceived contextual barriers and support factors play a significant role for the entrepreneurial behaviour of technical students. The authors claim that through public policy and university education, implementing educational, research and resource programs on entrepreneurship will help students gain the confidence, knowledge, and resources needed to become a business owner. In our project, this research is useful because we need to think of ways in which a new program will motivate students into learning about entrepreneurship, and help change students attitudes about being able to start their own business. There doesn't seem to be much, if any bias in the experimental design and conclusions, and the conclusions seem to conform to the ideas presented in other sources.

Mayhew, M. J., Simonoff, J. S., Baumol, W. J., Wiesenfield, B. M., & Klein, M. W. (2012). Exploring innovative entrepreneurship and its ties to higher educational experiences. *Research in Higher Education*, *53*(8), 831-859.

The article, authored by numerous professors at New York University, looked to analyze the entrepreneurial education experience of 3,700 students who graduated from one of five universities in 2007. The authors concluded that taking an entrepreneurial course in

one's undergraduate career, in accordance with the assessments that professors use, leads to students having much higher innovation intentions upon entering the real world. While current in its data, the scope of the article is not very large and moreover, the authors all originate from the same university which could lead to some form of bias in the writing. This said, the article could prove to be extremely useful in showing the effects and aftermath of an entrepreneurial education as opposed to some of the other articles which look more at the creation of a program.

McMullan, W., & Long, W. A. (1987). Entrepreneurship education in the nineties. *Journal of Business Venturing,* 2(3), 261-275.

This article talks about how entrepreneurship education should be set up within the 1990's. McMullan and Long both worked at the University of Calgary; McMullan in the Department of Entrepreneurship, Long in the Computer Science Department. Starting with a brief history on the entrepreneurship education programs since the 1960's, the authors try to explain the ideal students, teachers, curriculum, resources, and institutional features which should be involved with the education. Because entrepreneurship is different from most courses taught at a university, the authors claim and focus mainly on the idea the functional framework of management education is not appropriate for entrepreneurship education. The authors claim that creativity is the foundation or entrepreneurial thought and is not supported in business. The curriculum needs to account for the varying levels of venture development within entrepreneurship. The authors then go on to propose a curriculum, who the educators should be, the special resources required within the program, how to finance the education, and the institutional features of the program. This article is very useful for our project because not only does it explain the importance of entrepreneurial education, but sets a sort of guideline for institutions to start their own curriculum. While this article was made in 1987, the research and guidelines set should still be of much relevance to education today, and will be a good guideline for our proposed curriculum. Educational guidelines and intent have not changed much in the past few decades, so the date of the article shouldn't be an issue.

Oxford, C. (2012). Introducing the next level: Can you teach entrepreneurship?. *The New York Times*. Retrieved from http://boss.blogs.nytimes.com/2012/09/17/introducing-the-next-level-can-you-teach-entrepreneurship/

Written from a first person point of view the author spells out his path from an average worker to a rather successful entrepreneur through an education in entrepreneurship. Specifically he talks about ways in which the education was useful and particularly what he would have liked to know earlier in the process of starting his own business. Although only an individual's story, the article does help in that it presents a real life story with helpful tools that can be used and implemented into an educational course.

Pache, A., & Chowdhury, I. (2012). Social entrepreneurs as institutionally embedded entrepreneurs: Toward a new model of social entrepreneurship education. *Academy of Management Learning & Education*, *11*(3), 494-510.

As professors at Pace University in New York, these authors looked to propose a new framework/ approach when it comes to educating students about entrepreneurship. They emphasize a more social entrepreneurial education in which students are encouraged to acquire knowledge through active learning and participation. The authors reference three types of logic that they say students must grasp in order to fully understand how to think in the right mindset. These three types of logic are: social-welfare, commercial and public-sector logic. As opposed to the first part of the Fiet article (The theoretical side of teaching entrepreneurship) which emphasizes the theoretical side of educating, the authors of this article look more toward a pedagogical approach in teaching entrepreneurship. While possible biased in their approach from teaching such courses, this article may prove to be very useful in that provides another approach to educating students that differs with from some of the other articles.

Polczynski, M. H., & Jaskolski, S. V. (2005). Entrepreneurial engineering education. *In Proceedings of the NCIIA Ninth Annual Meeting*. 17-19

Polczynski, from The Technology Forge, and Jaskolski from Marquette University, define a problem with Entrepreneurial Education programs. They realize that both undergraduate and graduate programs in this field can improve both the quality and rate of development of entrepreneurial engineers. By acknowledging the role engineers play in business opportunities, the need for multi-disciplinary courseware and project activities focused on creating new opportunities in diverse environments is key to creating this future leader. Having a strong connection to business, investors, institutions, and already successful entrepreneurs as resources are all critical to the success of the programs. This article is useful because it defines the problem of curriculum and provides concrete solutions to help develop the program further. For a school with an non-established program, we can learn from the problems of other educational institutions and successfully be able to create a program without such problems.

Radharamanan, R. & Juang, J.N. (2012). Innovation and entrepreneurship in engineering education at MUSE. *Journal of the Chinese Institute of Engineers,* 35 (1), 25-36.

This article highlights the growing importance of entrepreneurship for an engineering curriculum. The authors present entrepreneurship education as a fundamental tool for succeeding in the increasingly globalized world. This article is presented in the context of economic and technological competition between the United States and developing nations such as China and India. The authors highlight a recently designed entrepreneurship engineering program present at the Mercer University School of Engineering (MUSE). The structure, key principles, and major projects of the program are outlined. This article provides strong insight on the methodology of designing a curriculum to promote entrepreneurial thinking and innovation within engineering students.

Ronstadt, R. (1990). The educated entrepreneurs: A new era of entrepreneurial education is beginning. *Entrepreneurship Education: Current Developments, Future Directions*, 69-82

As part of a much larger book that could prove to be useful in future research, the author of this chapter in particular presented an overview of what entrepreneurial education was and what it was becoming. Although slightly dated in its writings, the concepts, structures, and ideas that Ronstadt reveals make up exactly the type of information that our group is looking for. The authors approach is straightforward and may have to be updated but will certainly provide a solid basis upon which we can delve deeper. Looking specifically at how universities have taught entrepreneurship and how they should teach entrepreneurship the chapter in itself can be looked at as an extended guideline to our project.

Shane, S. (2010). Does Entrepreneurship Education Make People Better Entrepreneurs?. *Smallbiztrends* Retrieved from http://smallbiztrends.com/2010/09/does-entrepreneurship-education-make-people-better-entrepreneurs-2.html

The question posed by the author of this article hits right at the center of our group's Capstone project. The article itself looks to find the correlation between an entrepreneurial education and success of a self-made business. The author poses three main case studies which each end up yielding different results leading the author to conclude that an education in entrepreneurship could possibly help one run a business, but it also may not. Such a conclusion is not particularly helpful to us, but it does pose the necessary and important issue that this education may not have a direct correlation to the real world. In realizing this issue the article serves a purpose and will encourage us as team members and problem solvers to figure out a way in which the education can be more directly applied and prove to be useful.

Small Business & Entrepreneurship Council. (2013). *Small Business Facts*. Retrieved from http://www.sbecouncil.org/about-us/facts-and-data/.

Souitaris, V., Zerbinati, S., & Al-Laham, A. (2007*)*. Do entrepreneurship programmes raise entrepreneurial intention of science and engineering students? The effect of learning, inspiration and resources. *Journal of Business Venturing*, 22(4), 566-591.

This article tests the effect of entrepreneurial programs on the attitudes and intentions of science and engineering students through a study. Souitaris worked at the Cass Business School in London as a Professor in Entrepreneurship, Zerbinati as an associate professor in Entrepreneurship at Brunel University, and Al-Laham in International Entrepreneurship at the Technical University of Kaiserslautern. Using about 250 students from various colleges and putting them into control and experimental groups with a pretest and post-test design, the study finds that the most significant factors influencing entrepreneurial intent are learning, inspiration, and incubation resources. Testing numerous hypotheses, the results of the studies showed that post-program me values to subjective norm and intention towards self-employment were higher than that of pre-program. The study showed that entrepreneurship programs inspire students through

trigger-events, in which raise entrepreneurial attitudes and intentions. Inspiration is the main benefit of the program which develops the attitudes and intentions of students. Charismatic leadership is essential to changing the mindset of students, and is therefore a strong focus within the educational aspect. This article is very useful for our project because it shows how, while some students may already have the attitude needed to start their own company, the instructors and their curriculum are essential in helping students who want to become entrepreneurs. The 'implications for practice' within the article are certainly a good resource to use when deciding how the curriculum and the instructors should be shaped. As stated in the article, they do have certain limitations and biases; one limitation of the study was that the design was quasi-experimental because the groups were not random. However, the conclusions of the study should still be considered a useful guide.

Stillman, J. (2012). The best degree for start-up success. *Inc.* Retrieved from
http://www.inc.com/jessica-stillman/nerds-beat-suits-in-the-world-of-
entrepreneurship.html

Stillman, a freelance writer based in London, talks specifically about findings from a recent paper from 'Identified' titled, "Revenge of the Nerds". Looking at recent entrepreneurial success, they see that company leaders with only undergraduate education were evenly split between business and engineering degrees. The Internet was a foundation for more recent venture and start-up companies dealing mainly with technologies – IT, social and mobile industries. In the U.S., according to Global Entrepreneurship Monitor, 2011 saw an increase in the rate of entrepreneurial activity that has not been seen in the last ten years. This article directly shows the need and opportunity for more educational curricula which deals with entrepreneurial engineering, specifically in technologies dealing with the Internet.

Ulrich, A. (2013). Students explore entrepreneurship. *The Dartmouth.* Retrieved from
http://thedartmouth.com/2013/03/06/news/series

In this article, the author presents the effectiveness of student clubs in promoting entrepreneurial activity at Dartmouth University. These clubs include the Dartmouth Entrepreneurial Society, Mitosis, and the Kairos Society, attract students from diverse academic backgrounds. The clubs participate in entrepreneurship competitions such as DES's business plan competition. Additionally, the clubs have several strong connections with hiring firms. This article displays an alternative measure of promoting entrepreneurship for both engineers and other students. While this article sends a powerful message, it is not peer-reviewed, and therefore has limited reliability.

Vesper, K.H. & Gartner, W.B. (1997). Measuring progress in entrepreneurship
education. *Journal of Business Venturing,* 12 (5), 403-421

This article presents the results of a survey that looked at 311 different universities' entrepreneurship programs from around the globe analyzing the various outcomes and parts of the curriculum that were deemed important in educating students. In attempting

to re-evaluate the way in which entrepreneurship programs were rated and compared, the authors, both of who are professors, one at the Graduate School of Business at the University of Washington and the other at the School of Business Administration at the University of Southern California, proceeded to create sub-categories for which a program could be broken down and looked at. The result was such categories as leadership, information and analysis, strategic and operational planning, human resources development and management, and educational and business process management. Moreover, the authors emphasize the need for direct and implicit goals of one's program. As professors from other schools' entrepreneurship programs the article could hold a slight bias toward a certain way of teaching. Although from 1997, the article still creates a general guideline that entrepreneurship programs can look at and self-evaluate.

Wasserman, N. & Hwang, V.W. (2012). Can entrepreneurship be taught? *The Wall Street Journal.* Retrieved from http://online.wsj.com/article/SB10001424052970204603004577267271656000782.html

This article debates the effectiveness of teaching entrepreneurship principles to individuals. One author, Mr. Wasserman, suggests that entrepreneurship is a topic that can be learned in the same manner as engineering principles. He suggests that analyzing past entrepreneurial activities and extracting key lessons can allow individuals to succeed as entrepreneurs. The other author, Mr. Hwang, suggests that real-world experience is the only way to understand entrepreneurship. He declares that the complicated nature of decision making in the professional world, as well as the necessary personal and leadership skills, cannot realistically be taught in the academic world. This article provides the larger professional context in which entrepreneurship academic programs are set it. Its use of two opposing views provides a strong, broader view of the overall debate.

Wee, K.N.L. (2004). A problem-based learning approach in entrepreneurship education: Promoting authentic entrepreneurial learning. *International Journal of Technology Management*, 28 (7), 685-701

This article discusses the effectiveness of the lecture based system when it comes to entrepreneurship education. The author, a professor at the Republic Polytechnic in Singapore, argues that there should be a change in the content and process in order to provide for a more authentic learning experience that can better ready students and graduates for real world entrepreneurship. Revolving mainly around the experience of students at the Singapore school, the author argues, and provides evidence for the success of problem-based learning and shows how it can be implemented. Such an article could prove to be extremely useful in deciding what type of entrepreneurial classes should be offered and how they should be executed. While the article mainly applies to that of a specific school and therefore may not be overarching or universal in its lessons, it does provide strong inference as to how one could go about implementing a learning-by-doing approach into an educational institution.

Whittaker, J. (2001). Engineers, entrepreneurs and the commercialization of technology. In management of engineering and technology. *Portland International Conference on IEEE,* 81-84

Whittaker, from the Department of Mechanical Engineering at the University of Alberta, focuses his article on the idea that engineering and entrepreneurial skills are essential in the commercialization of technology. Because engineering generally favors technical skills and risk aversion, the professional's skill set does not mesh well with the entrepreneur who is visionary, risk taking, and good with communication. Because of this tension, it is tough to find an individual who can combine these skill sets to become a future leader in industry. Whittaker goes through and talks about the concerns and implications of entrepreneurial engineering, talking about tension and the work environment, education and inclination towards entrepreneurship, the difference (and main concern) over engineers and entrepreneurs, and the implications of his work. Basing his conclusions off of case studies such as the 1998 Harvard Business Review article, "Strategic Stories: How 3M Is Rewriting Business Planning.", he claims that the tension between the two seemingly different fields and attitudes is essential to the success of a company. Whittaker admits that there are questions that stem from his paper which lead to further study, such as, should engineering management programs be concerned with teaching students how to be entrepreneurs, or how to work with entrepreneurs? This article is useful because it does give a different view on entrepreneurial ventures and engineering than many other articles which only state the necessity of the combination, and not necessarily some of the drawbacks.

Zhou, Z., Zhao, Y.Y., & Katzy, B.R. (2012). Entrepreneurship as a field of study in engineering management. *2012 IEEE International Technology Management Conference*, 308-317.

In this paper, the authors discuss the growth of entrepreneurship as a field of study as well as its strong relevance to engineering. The authors argue that both engineers and entrepreneurs are viewed as "creators," and that the two disciplines are complementary. The article discusses the positive spillovers that occur when individuals are able to blend the fundamental concepts of engineering and entrepreneurship. Individuals will possess the organizational and technical expertise of an engineer as well as the creativity, decision-making, and psychological background of an entrepreneur. This type of versatile engineer possesses the innovation and flexibility to succeed in the rapidly changing global market, highlighting the importance of entrepreneurship to engineering programs.

Zwilling, M. (2012). It's a big step from engineer to entrepreneur. *Forbes*. Retrieved from http://www.forbes.com/sites/martinzwilling/2012/02/16/its-a-big-step-from-engineer-to-an-entrepreneur/

Zwilling, a contributor to Forbes, provides pragmatic advice and services to entrepreneurs and startups. He claims that, while many engineers believe they have the competitive edge in starting their own company, in reality and in a recent Duke and Harvard survey, only 37% of over 500 technology companies had leaders with

engineering or computer science backgrounds. Using Uppuluri's recent book, "Engineer to Entrepreneur: The First Flight" as a resource, Zwilling helps identify major misperceptions most engineers have about businesses and their lifecycles. His major claims are that entrepreneurs should assess commercial viability of their products, a team with diverse skills is more likely to build a thriving business but is harder to manage, connecting with customers is key, and that entrepreneurs have to be risk takers, which directly conflicts with the engineering education and mindset. Claiming that the Internet is the 'equalizer' for engineering entrepreneurs, Zwilling realizes the potential opportunities for future start-up companies. This article helps show that, while there are certain misconceptions as to the ease of engineering entrepreneurship, there is certainly a big demand and opportunity for future ventures. This will stem from the education which these engineers get, and by addressing the idea that there is an opportunity for entrepreneurship in engineering will help streamline the implementation of new curricula.

2) **Entrepreneurship Minor Program Complete Course Listing**

Prerequisite:

Principles of Economics (ECON 101)

Required:

Introduction to Entrepreneurship (ENT 110)

Entrepreneurship Marketing & Finance (ENT 210)

Capstone: Entrepreneurship and Business Development (ENT 480)

Free Electives (Choose 3)*:

Entrepreneurship Internship (ENT 481)

Introduction to Engineering and Public Policy (EP 251)

Engineering Economics and Management (EGRS 261)

Building High-Tech Start-up (EGRS 371)

Management of Technology and Innovation (EGRS 462, Cross-Listed ENT 310) [W]

Engineering Professionalism and Ethics (ES 225) [W]

Engineering America (ES 252) [W]

Technology Clinic (INDS 321) [W]

Multinational Business and Corporate Social Responsibility (PSTD 255)

Industry, Strategy, and Policy (PSTD 300)

Social Behavior (PSYC 235)

Advertising and Promotion Design: Differences in Conceptualization (ART 190)

Visual Communication through Technology (ART 292)

Elective Note:

*At least one elective must be a technical course

*At least one elective must be a writing course