

# A project-based approach to entrepreneurial leadership education

Gül E. Okudan<sup>a,\*</sup>, Sarah E. Rzasa<sup>b</sup>

<sup>a</sup>*Penn State University, School of Engineering Design and Professional Programs, 213T Hammond Building, University Park, PA 16802, USA*

<sup>b</sup>*Penn State University, Schreyer Institute for Teaching Excellence, 301 Rider II, University Park, PA 16802, USA*

## Abstract

This paper discusses the evolution of the Entrepreneurial Leadership course (ENGR 310), which is one of the four core courses at The Pennsylvania State University (Penn State). The current teaching practices in the course, based on project-based learning practices, have been developed based on a comprehensive review of similar courses and entrepreneurship education literature. This paper discusses the new course curriculum, and relevant innovative changes. The results of a comprehensive assessment conducted to measure student satisfaction and perceptions of the course are included along with a summary of the experience gained while teaching the improved version of the course. In addition to the assessment results, two other results attest to the success of the course: (1) All teams completing the build and sell project made profits. In fact, one team made about \$700 in profit, a great accomplishment considering the time they were allotted to work on the project. (2) Most students taking the class, who were not graduating, decided to enroll in the Entrepreneurship Minor. This paper aims to share implementation of these changes as an avenue for entrepreneurship educators to learn from others' experiences, and to contribute to the entrepreneurship education literature.

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## 1. Introduction

Entrepreneurial Leadership is one of the core courses of the Entrepreneurship Minor of the College of Engineering at The Pennsylvania State University. Entrepreneurial Leadership was offered during the Fall 2001 semester for the first time. The first version of the course included various topics such as leadership and management, social leadership, values and ethics, understanding human behavior, teams and stages of team development, organizations, the nature of entrepreneurial work, how organizations work, and leadership development. During the second half of the course, a problem-based learning approach was utilized, assigning the students ( $n=15$ ) to work as one unified venture team with the goal of completing one business plan. Since its first offering, the course was improved in each successive semester it was offered. For example, rather than having the entire class of students complete one single venture creation project, the course was broken down into

3–4 person student teams. Each team was asked to write business plans. In addition, the course began to include a focus on product innovation and improvement. When compared to previous versions of the course, however, recent changes incorporated to the course have been more radical. These changes were introduced after a comprehensive review of similar courses and entrepreneurial education literature. This paper aims to document and share implementation of these changes as an avenue for entrepreneurship educators to learn from others' experiences.

Remaining parts of the paper include a review of the literature regarding the teaching of contemporary entrepreneurial leadership. In addition, a statement of revised course objectives, a description of the course content and delivery and the results of the course assessment are provided.

## 2. A review on contemporary entrepreneurial leadership teaching

In order to understand the current practice in entrepreneurial leadership teaching, an on-line search was

\* Corresponding author. Tel.: +1 814 863 1530; fax: +1 814 863 7229.  
E-mail address: [gek3@enr.psu.edu](mailto:gek3@enr.psu.edu) (G.E. Okudan).

Table 1  
Entrepreneurial leadership courses

Institution/Course Number and Title/ Text(s) or Main Topics
<p><b>The George Washington University</b> Course I: Foundations of entrepreneurial leadership for women <i>Entrepreneurship Ideas in Action Workbook</i>, 2nd edition. South-Western, 2004. <i>Learning to Lead: A workbook on becoming a leader</i> by Joan Goldsmith, Perseus 1997.</p>
<p><b>University of Dayton</b> MGT 402: Leadership and Motivation Individual/team motivation in organizational settings. Focus on how leaders can understand, and affect motivation through multiple ways.</p>
<p><b>Tufts University</b> 107: Entrepreneurial Leadership Facing challenges associated with managing a growing enterprise; recognizing and choosing opportunities; establishing and communicating a vision; hiring, managing, and retaining employees; developing networks and forming partnerships with suppliers or customers; selecting and developing technology or a new product/service.</p>
<p><b>McGill University</b> AGEC-344A 01: Entrepreneurial Leadership <i>Leadership: Theory, Application, Skill Development</i>, Robert N. Lussier and Christopher F. Achua, South-Western College Publishing ISBN 0-324-04166-7.</p>
<p><b>Babson College</b> MOB7570-61: Leadership Attention is given to leading up, down, and across the organization. Through cases, readings, experiential activities, practice in developmental coaching, field projects, and colleague feedback, students gain greater insight and skill in leading. Topics include behavior of effective leaders, the use of vision, power and influence strategies, building high performance teams, crisis management, organizational politics, and dealing with multiple stakeholders.</p>
<p><b>Rice University</b> Univ313: Entrepreneurial Leadership <i>The Portable MBA in Entrepreneurship</i>, 2nd Edition, William D. Bygrave, John Wiley and Sons, 1997.</p>
<p><b>Virginia Technical University</b> MGT 5814: Entrepreneurial Leadership Concepts and techniques for providing leadership in the entrepreneurial venture. Provides the theoretical understanding of the entrepreneurial process in the economy as well as the practical leadership, marketing, financial and production considerations for entrepreneurial initiatives for new ventures and established firms.</p>
<p><b>Gonzaga University</b> ENTR 481: Entrepreneurial Leadership Examines the personal characteristics of the successful entrepreneur and the fundamentals of ethical leadership. Emphasizes the critical need for entrepreneurs to understand and contribute to the common good.</p>

completed for keywords ‘entrepreneurial leadership course(s)’. This search has returned several course listings in many institutions. Table 1 summarizes these courses. When a textbook was listed on the course website, its citation was used in lieu of the course description while compiling the information for Table 1. The search was completed during March 2004.

As seen in Table 1, while there are similarities in these course offerings such as inclusion of basic leadership topics (motivation, performance, etc.), they did not have a consensus on either the text used or the emphasized areas of content. This was assumed to be a result of course customizations due to varying needs of the student body and missions of the institutions involved. Thus, the potential contributions of each change to the entrepreneurship education of the students within the minor were weighed carefully before implementation. Indeed, planned contributions of the course were identified as knowledge and skill development in the areas of leadership, motivation, innovation, communication skills, teamwork and writing business plans. Accordingly, a content and delivery revamp was undertaken to make the knowledge and skill development in the intended areas possible.

First of all, a search was performed to find an appropriate text to support the course content. Finding the right textbook for any course is important, yet not always easy. Likewise, finding the textbook for the Entrepreneurial Leadership course was a challenge, even though many books were found that had ‘entrepreneurial leadership’ in their titles.

Indeed, there are several books with similar titles such as *Leadership and Entrepreneurship: Personal and Organizational Development in Entrepreneurial Ventures* (Smilor and Sexton, 1996), *Creating Value Through Skill-Based Strategy and Entrepreneurial Leadership* (Schulz and Hofer, 1999), and *Contemporary Leadership for Entrepreneurial Organizations: Paradigms, Metaphors and Wicked Problems* (Eggert, 1998). However, after a review, none of these books were found to be appropriate for the course. Then, basic leadership texts were consulted such as those used for courses in Table 1, and other leadership courses within the Penn State system such as *Leadership: Theory and Practice* (Northouse, 2004). This search did not bring answers either. Thus, in search for the appropriate textbook and for what changes needed to be implemented in the course going back to the published literature on

entrepreneurship education was preferred. What follows is a brief summary of the findings of this search.

### 3. A literature review on entrepreneurship education

While entrepreneurship requires an attitude towards risk taking and using one's gut feeling, it is widely accepted that many aspects of entrepreneurship can be taught (Garavan and O'Connell, 1994). Most entrepreneurship programs aspire to stimulate independent small business ownership or opportunity-seeking behavior in managers within companies. Sexton and Bowman (1984), however, suggest that a clear distinction should be made between 'entrepreneurship' and 'small business ownership'. According to them, all entrepreneurs are self-employed but all self-employed are not entrepreneurs, because entrepreneurs are characterized by innovative behavior with the main goal of obtaining profit and growth.

Entrepreneurship education has been recognized as one of the crucial factors in fostering entrepreneurial attitude (Gorman et al., 1997; Kourilsky and Walstad, 1998). Despite this fact, however, after reviewing entrepreneurship education, Hindle and Cutting (2002) state "...empirical tests of key propositions are in short supply and badly needed as demonstrations of the efficacy of entrepreneurship education programs." Similarly, Sexton and Bowman (1984), Hills (1988), McMullan and Long (1983) and Vesper (1982) found that there is a lack of accepted paradigms or theories of entrepreneurship education. This was later suggested to be due to the lack of a body of well-researched and developed knowledge, which might form the basis of entrepreneurship education (Gibb, 1987; Sexton and Kasarda, 1991). Nevertheless, from the literature on entrepreneurship education some insights can be gained and used when shaping entrepreneurial education in an institution. For example, (1) affective socialization element, (2) making decisions with insufficient information, (3) learning style, and (4) adoption of entrepreneurial behavior are important components to consider when developing an entrepreneurial program. These insights are explained below.

- *Affective socialization element* is defined as a combination of mindsets, values, attitudes, and strategies necessary for an occupation. Affective socialization is seen as an important element for an education program (Curran and Stanworth, 1989). Curran and Stanworth (1989) argue that socialization process of entrepreneurs should reflect the highly isolated and semi-structured entrepreneurial role with few partners in an inherently high level of uncertainty.
- Gibb (1987) states that most business-school based entrepreneurship education adversely impacts the entrepreneurial spirit. Because in these settings, the emphasis is on analysis of large amounts of information, largely in

the classroom with information from experts, and with evaluation by written assessments. In contrast, the entrepreneur with limited resources mostly operates with gut feeling, recognizing the hidden agendas of others' goals, and making decisions on the basis of trust and competence of those involved (Garavan and O'Connell, 1994). Thus, Gibb (1987) suggests (1) developing an independence from external sources of information and expert advice, and (2) use of feelings, attitudes and values outside of information as improvements for entrepreneurship education.

- For effective entrepreneurship education, a medium that employs concrete experience, reflective observation, abstract conceptualization and active experimentation should be present (Davies and Gibb, 1991). However, when compared to reflective observation, it is suggested that active experimentation is more natural for stimulating entrepreneurial behavior (Garavan and O'Connell, 1994; Ulrich and Cole, 1987).

Entrepreneurial behavior is described as the processes, practices, and decision-making activities that lead to entrepreneurship (Lumpkin and Dess, 1996). According to Lumpkin and Dess (1996), key entrepreneurial processes include autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness. Autonomy refers to the independent action of a person in carrying an idea or a vision through completion. Innovativeness is the tendency to engage in new ideas, and experimentation that may result in new products. Proactiveness implies acting in anticipation of future problems, needs or changes. Competitive aggressiveness is directly and intensely challenging competitors. An effective entrepreneurial education should provide a medium to practice these entrepreneurial behaviors.

As for content of the entrepreneurship education, Knight (1991) suggests opportunity identification, strategy development, resource acquisition and implementation as core parts of the curriculum. McMullan and Long (1987) argue that entrepreneurship education should include skill-building courses such as negotiation, leadership and creative thinking and exposure to technological innovation and new product development. Hood and Young (1993) propose a framework consisting of four primary areas where successful entrepreneurs must be developed: (1) content, (2) skills and behavior, (3) mentality, and (4) personality. These areas were proposed based on results from a survey of 100 chief executives in entrepreneurial firms. In the survey, the executives indicated that *marketing* is the most important content area, *leadership* is the most critical skill, and *creativity* is the most important cognitive skill (mentality). In addition, they believed that while personality traits are difficult to influence, the vast majority of the knowledge required by entrepreneurs can be taught.

Mindful of these findings in entrepreneurship education, the entrepreneurial leadership course at Penn State was

Table 2  
Leadership skill development

Leadership Text, Complementary Handouts on <i>Entrepreneurship</i> , Product dissection project	Overview of the E-ship Minor Course overview and syllabus Self introductions Visioning Create and Lead Teams Coaching and Training Implement Employee Involvement Strategies Communicating Teamwork Product Dissection-II Self Direction Creative Problem Solving Build Appropriate Relationships Flexibility Professionalism <i>Product Redesign Report and Presentation</i>	The Pyramid of Leadership Leadership Abilities Foster Conflict Resolution Assess Situations Quickly and Accurately <i>Product Vision Presentations</i> <i>Process Definition Presentations</i> Product Dissection-I Guest Speaker (Entrepreneur in class) Interpersonal Skills Manage Client Relationships Financial Awareness Business Acumen and Technical Competency <i>Test on Leadership and Entrepreneurship Concepts</i>
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revised. The overall goal of the revision was to integrate what was learned from the literature and the survey of similar courses into a meaningful learning experience for students who are choosing to develop their entrepreneurial skills. Three major objectives for the revision are given below:

1. Facilitate knowledge and skill development in the areas of leadership, motivation, innovation, communication skills, teamwork and writing business plans,
2. Facilitate knowledge and skill development in ways that encourage entrepreneurial behavior by (a) creating an environment for affective socialization, (b) developing a comfort level with insufficient information, (c) incorporating active learning to the classroom, and (d) encouraging creativity, proactiveness, risk-taking and competitive aggressiveness.
3. Emphasize leadership, marketing, and creativity.

The following section describes the revised course along with a comprehensive assessment of its effectiveness.

#### 4. Revised entrepreneurial leadership course

Tables 2 and 4 include the sequence of topics for the revised course. Overall, the course is thought to have two foci: (1) leadership skill development, which utilizes concrete experience, reflective observation, abstract conceptualization and active experimentation; and (2) business plan development and implementation, which primarily utilizes active experimentation.

A leadership text by Don Clark (2001) has been adopted for the course with the goal of stimulating abstract conceptualization and adoption of common terminology on leadership concepts. The method used to teach the leadership concepts is interactive and involves each student’s reflection and presentation of his/her opinion. In addition, four small team projects are assigned as means for concrete experience and active experimentation, during which each student assumes a leadership position at least once. These projects and their learning outcomes are summarized in Table 3.

Table 3  
Team assignments

Team Assignments	Assignment Take-Away Points
<b>Product Vision:</b> Student teams are provided with different brands of electric toothbrush and are asked to develop the product vision for the following 2–5 year range.	Vision defines goals and objectives to accomplish. It is generally leader’s responsibility to formulate the vision. When a vision related to a product considered, it defines the battleground (your competitors). For a product vision that will yield success (\$), know your market, know your core competencies.
<b>Process Definition:</b> Student teams (each having engineering and business students) are asked to put together the process definition for producing, marketing and selling electric toothbrushes.	When business <i>and</i> engineering plans are not complete for a product, you cannot communicate, “you know what you are doing”, and thus getting people to buy in is very hard. Have the complete picture on business and engineering issues. This will help you project confidence, and people will more likely invest in your idea. Make sure it is clear that making money with this idea is a sure thing!
<b>Product Dissection:</b> Student teams are guided through dissecting the electric toothbrushes and collecting useful information.	It takes a lot to design and manufacture a product. Especially given the market price and profit margins of products! Being better than the competition is not easy...
<b>Product Redesign:</b> Student teams are asked to redesign their toothbrush to have a competitive advantage.	A profitable redesign of a product requires an innovative way of producing it cheaper, better, faster, or more flexible.

Table 4  
Business plan development and implementation

The Successful Business Plan Text, Build and Sell Project	Introduction to Business Plan Writing and Build and Sell Project Target Market Strategic Position and Risk Assessment Operations Management and Organization The Financials <i>In class competition. Business Plan Due</i>	Industry Analysis and Trends  Competition Marketing Plan and Sales Strategy Technology Plan Development, Milestones and Exit Plan Project Time Entrepreneurial Design Competition
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Out of four team projects given in Table 3, the fourth one is the most challenging. It requires each student team to compete for seed money (between \$0 and \$200) for the build and sell project. This competition is judged by two investors. The assessment of learning of leadership concepts is through a written test, where students are asked to recall basic concepts and how they might use them. Students are then expected to incorporate these concepts into the team projects.

Table 4 shows the sequence of the topics that are covered throughout the second part of the course, for which active experimentation, or 'learning by doing', is essential. Student teams, in this portion of the course, not only develop a business plan for a product but also build the intended product and sell it. A 10% portion of their final grade is dependent upon whether students make a profit. Due to time constraints students are encouraged to engage in innovative products of easy to shape and of less sophisticated material (such as cardboard, wood etc.). For a textbook, *The Successful Business Plan: Secrets and Strategies* by Rhonda Abrams is used throughout the second half of the course.

## 5. Course assessment

After the changes in the course were planned and articulated in a detailed syllabus, the assessment team of the Entrepreneurship Minor was contacted to complete a thorough assessment. This assessment team has been involved in the evaluation of curricular changes in the minor throughout its history. In fact, the minor has undergone significant summative and formative assessment, using both qualitative and quantitative methods, to better understand programmatic effects and to guide decision making (Rzasa et al., 2004; Wise et al., 2003).

### 5.1. Procedures

In order to perform a comprehensive assessment of the revised course, a mixed methods approach consisting of both qualitative data from focus groups and quantitative data from a survey was utilized (Teddlie and Tashakkori, 2003). A concurrent triangulation data collection design was implemented, with the intent that the results of the different methods could potentially help to confirm and corroborate findings (Cresswell et al., 2003).

Three focus groups were held during a designated class period at the end of the Spring 2004 semester. Three assessment specialists, external to the class, moderated the focus groups. Students were randomly assigned to one of the three focus groups.

The focus group protocol, available in Appendix A, was created based on the following assessment questions:

- Is the classroom operating in an environment of affective socialization?
- Does the classroom provide an environment favorable to the entrepreneurial spirit by allowing students to develop an independence from external sources of information?
- Is the classroom operating in an environment of active experimentation?
- Does the class impact key entrepreneurial processes such as autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness?

In addition, formative assessment was incorporated into data collection. Therefore, students were also asked what they thought needed to be improved or changed with the class. In order to counteract possible order effects and to control against losing information due to lack of time, the questions were ordered differently for each focus group moderator. The focus groups were videotaped and later transcribed. The transcripts were imported into N-Vivo, software designed to facilitate qualitative analyses. A basic coding scheme was created based on the assessment questions. Following this basic coding scheme, content analysis was performed using a grounded theory approach, adding and revising themes as necessary (Strauss and Corbin, 1998).

Following the focus group, students were asked to anonymously complete a background questionnaire and a 22-item Likert-type scale designed to measure students' perceptions regarding the effects of the course. The scale used five responses: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. Appendix B provides the questions used in the background questionnaire and Likert-type scale. Frequency and averages were calculated for each item.

### 5.2. Participants

A total of 22 of the 24 students enrolled in the course participated in the focus groups and completed



the Likert-type scale. Six students were majoring in business. One student was majoring in information science and technology. The remaining students were majoring in engineering (mechanical engineering—2, industrial engineering—5, computer engineering—1, electrical engineering—5, civil engineering—1, nuclear engineering—1). A total of 19 students, 86%, were planning to complete the requirements for the entrepreneurship minor. The average semester standing of the students was approximately 5.6. A total of 3 students reported themselves as seniors. Eleven students reported themselves as juniors. Seven students reported themselves as sophomores. Only three students participating in the study were females (13%), a slightly lower percentage than exists in the College of Engineering population (16%).

### 5.3. Results

For each of the assessment questions, a combination of Likert-scale items and focus group questions were utilized. The results of the qualitative and quantitative data are directly compared for each question.

#### 5.3.1. Is the class operating in an environment of affective socialization?

From the focus group information, students addressed that, to an extent, the class did provide a simulation of what it is like to be an entrepreneur. In particular, one student mentioned that the scaffolded nature of the projects reflected the processes that an entrepreneur will face when developing a new product or company:

- I think that the way that the projects progressed [reflected what it is like to be an entrepreneur]. You start small with a vision... if you wanted to be an entrepreneur, it's the exact direction of how you need to go to become a successful entrepreneur. You need a vision. In the beginning of the class, you start with a vision; you talk about your competitors, your competitor's products, and do the dissection. And down the road, you build and sell your product... So I think that the way that the class was structured is more or less as in real-life. I think that was a good way for us to understand what exactly goes on.<sup>1</sup>

Other ways that students thought that the class simulated entrepreneurship was through the diverse teams that they worked with throughout the projects:

- It forces you to work with people who aren't the same major as you. And that's exactly what you're going to be doing when you start your job and you're going to be working... people with a vast background. It teaches you to work with other people with not necessarily the same degree.

- I think the goal was to learn how to integrate an engineer and a businessperson and work together to fill in each other's weak points and try to succeed.

Several students noted that the classroom provided them with the necessary skills and knowledge needed in order to become an entrepreneur. They realized the necessity of business knowledge and gained a greater understanding of the challenges and obstacles associated with beginning a new endeavor.

- [N]ow that I've taken this class, it definitely has given me the weapons and the skills to know what I need, the things that you need to know to be an entrepreneur. If I would have never taken this class, and I was to become an entrepreneur, I don't think my first project would have been successful... It prepares you.
- You get to encounter a lot of the obstacles that you would [as an entrepreneur]... You really make good sense of every step.
- After taking this class, I know if I'm going to start my own company, that's going to be a lot of work. I'm not going to do it until I'm really ready for it.

Students realized that the classroom was unable to completely simulate the life of a real entrepreneur. They realized that the classroom environment was much simpler than what would be actually required of an entrepreneur: "It might not be on the full scale. It's scaled down." In addition, some aspects of entrepreneurship were difficult to simulate in the classroom. In particular, students mentioned the amount of risk that the entrepreneur faces would be difficult to simulate in the class:

- There's not too much risk involved.
- I think it's kind of hard to simulate the amount of pressure that you have.

In addition, one student noted that the restrictions placed on the projects also limit how entrepreneurship can be simulated:

- From the creativity aspect, she told us [the project] had to be something out of cardboard. For a real entrepreneur, you just make whatever you want. We kind of had restrictions on it.
- I think the limits that she gave us were too specific... If it were more general, it might have been more effective.

Six Likert-type questions were used to tap the idea of affective socialization to which the majority of students agreed or strongly agreed. Table 5 displays the frequency data for each of the six items. The majority of students agreed or strongly agreed that they have a better understanding of the necessary skills and knowledge in the path of becoming an entrepreneur. Fewer students thought that the course simulated what it is like to be an entrepreneur. Most

<sup>1</sup> Quotations from students were edited slightly to improve readability.

Table 5  
Statistics for affective socialization items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. I better understand what it takes to become an entrepreneur.	0	1 (4.5%)	0	11 (50%)	10 (45.5%)	4.36
2. I better understand what starting my own company will be like.	0	1 (4.5%)	1 (4.5%)	10 (45.5%)	10 (45.5%)	4.32
3. I have a better understanding of what an entrepreneur does.	0	0	3 (13.6%)	8 (36.4%)	11 (50%)	4.36
4. This class simulates what it's like to be an entrepreneur.	1 (4.5%)	0	5 (22.7%)	12 (54.5%)	4 (18.2%)	3.82
5. I now believe that it is possible for me to be an entrepreneur.	0	2 (9.1%)	2 (9.1%)	12 (54.5%)	6 (27.3%)	4.00
6. I can better see myself starting my own business or company.	0	3 (13.6%)	5 (22.7%)	9 (40.9%)	5 (22.7%)	3.73

likely, the reason for the reduced level of agreement is due to the factors discussed above, such as the inability to simulate financial risk and pressure. Interestingly, almost 40% of the students either disagree or are neutral that they can better see themselves starting their own business or company. One possible reason for this is that the course provides an introduction to the difficult realities that entrepreneurs face. As one student mentioned after hearing a guest speaker who was a local entrepreneur: 'It really made you understand how much they go through. How much time and effort it really takes. And how much time it takes away from their families.'

In general, however, the class does appear to be providing an environment of affective socialization for students wishing to become entrepreneurs. The projects appear to be effective in guiding the students through the process of designing a product and carrying it through to fruition. The environment is understandably operating at a simpler level than would be expected of a true entrepreneur with some limitations being placed on the amount of risk and pressure that students experience.

### 5.3.2. Does the classroom provide an environment favorable to the entrepreneurial spirit by allowing students to develop an independence from external sources of information?

During the focus groups, students were specifically asked what strategies they would use when encountered with a situation where they did not have a lot of direction. The initial reaction in each of the three focus groups was to state a desire to contact the instructor, who would be considered the expert in this situation. As several students noted:

- The most logical thing is to ask the professor.
- If it was something along like the business material or anything like that, you could always ask.

- [When I was confronted with this type of situation, I] went to her. I just e-mailed her this morning and asked her a few questions. She got back to me in a half and hour and helped me out.
- I just go to her with the questions.

No students suggested relying on their feelings, attitudes, or values when faced with a situation where they did not have guidance. However, students did acknowledge the importance of being able to make a decision independently of an expert and to make decisions within the team itself:

- It sort of made us realize that it's up to us the way to do it. We can find the most efficient way to get things done. There's not one set plan to follow.
- There's not always going to be a professor to ask after school. You're going to have to work on it with a co-worker to figure it out.
- You're not always going to have someone to ask or show you how to do something.

Three questions from the Likert scale were used to tap whether students were more able to make decisions independently. Table 6 provides the results of these items. While almost 80% of the students strongly agreed or agreed that they could better make decisions independently, only approximately 40% of the students felt that they were more likely to rely on their gut feelings. This corroborates the findings above. Most of the students still appear to rely heavily on the advice of the instructor. However, over 70% of the students felt that they had developed a trusting relationship with their team. This supports the fact that several of the students felt that they could go to their team for advice and begin to trust them in the decision making process.

Table 6  
Statistics for independence items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. I can more easily make decisions independently.	0	1 (4.5%)	4 (18.2%)	14 (63.6%)	3 (13.6%)	3.86
2. I am more likely to rely on my gut feelings and instincts than on advice from others.	1 (4.5%)	3 (13.6%)	8 (36.4%)	5 (22.7%)	4 (18.2%)	3.38
3. I developed a trusting relationship with my team.	0	1 (4.5%)	5 (22.7%)	7 (31.8%)	9 (40.9%)	4.09

Table 7  
Statistics for active experimentation items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. I enjoyed the active learning style used in this class.	0	0	1 (4.5%)	6 (27.3%)	15 (68.2%)	4.64
2. The teaching style used in this class matches my preferred learning style better than most classes.	0	1 (4.5%)	4 (18.2%)	4 (18.2%)	13 (59.1%)	4.32

### 5.3.3. Is the classroom operating in an environment of active experimentation?

Students were asked their perception of the classroom environment and the active teaching style. They were overwhelmingly positive about the active teaching style of the instructor who was described as extremely enthusiastic and supportive. They particularly enjoyed the ability to apply the concepts that they learned into meaningful activities. The projects and presentations allowed for a more active learning style, which seemed to benefit many of the students. Following are some of the overwhelming positive statements regarding the active nature of the class:

- I think in this particular class the tests that you take aren't necessarily going to teach you the material that they're trying to teach. I know that I've learned more from this class than I've learned from any other class. I've learned so much book-stuff in my other classes. But actually getting out there and using my knowledge and my skills, I think taught me more than any of my other classes.
- Instead of a teacher standing up there lecturing, it was us going up there and talking about what we read. She would constantly be there for the students. You also have the opportunity to get up there and speak publicly to your peers. I think that was a great way to conduct the class and get the information across.
- When classes have a final project where everyone gets to apply what they learned, it just makes the class a lot more interesting and better and you see the point. For other classes where you just sit there and read and just receive a lecture, I just feel that it all goes out the window.
- I found myself falling asleep in a lot of the other classes just sitting in the chair the whole time. But here we're forced to read a chapter the night before and then get up in front of the class and talk to the class and almost give your own lecture. So you were up and moving constantly and that helped me personally absorb the information. It was moving around and not falling asleep the whole time.

Not only did students find these classes more interesting, they believed that they learned better, were more motivated, and were more apt to prepare for class.

- If it's more active and more active I am on my end, the more I learn.
- I know in other classes, there's only one midterm and one final. You get so far behind. I come to [this] class prepared.
- It made you want to keep up and read when you had to read to keep from falling behind.

Two survey questions were used to better understand students' perceptions of the active learning style used in the class. Table 7 provides the results of these questions. An overwhelming majority of the students, 95%, agreed or strongly agreed that they enjoyed the active learning style used in the course. Also, almost 80% of the students agreed that their learning style was better matched in this course than in traditional courses. These results certainly tend to corroborate the tremendously positive reactions during the focus group.

In conclusion, students had an extremely positive view of the instructor and the active experimentation used in the class. Several students felt that this helped learning and increased motivation.

### 5.3.4. Does the class impact key entrepreneurial processes such as autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness?

Autonomy refers to the 'independent action of an individual or a team in carrying an idea or a vision through completion'. As mentioned above in the section on making decisions with insufficient information, while most teams were able to work successfully, students still relied heavily on the guidance of the instructor. In general, however, students reported that they were able to complete their projects successfully. One group did mention that the most negative experience with the course was that sometimes teams did not mesh well together:

- The only unpleasant experience that we as a group had was that we did have one group member who constantly did not show up for meetings and stuff like that and was seldom in class. That was kind of difficult to work with. That would be the only unpleasant experience that we had. Everything else for the most part was really a great learning experience.
- The only problem is having groups and individual people you have to work with.

However, as one student noted, this is an obstacle that leaders need to deal with and overcome in order to be successful:

- It's a leadership class and if you want to learn how to be a leader then you have to deal with certain atmospheres and situations.

This did not appear to be a large enough obstacle to deter projects from being completed successfully. Most of the team projects were thought to be a success.



Table 8  
Item statistics for autonomy items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. My team was able to complete the projects independently.	1 (4.5%)	0	2 (9.1%)	13 (59.1%)	7 (27.3%)	4.05
2. I hope to continue to work on the ideas/projects that originated in this class.	1 (4.5%)	1 (4.5%)	7 (31.8%)	5 (22.7%)	8 (36.4%)	3.82

Two survey items were used to tap the concept of autonomy as shown in Table 8 below.

While most students (86.4%) that their team was able to complete the assigned projects, fewer (59.1%) believed that they would continue on their creative ideas after the class ends.

Innovativeness refers to ‘the tendency in engaging in new ideas, novelty, experimentation that may result in new products’. Students were asked to reflect on the impact the class may have had on their ability to be creative and to think innovatively. Their perceptions seemed somewhat mixed. Some students believed that the projects definitely helped them to express their creativity:

- I love the fact that a lot of the projects were unstructured. There’s a lot of openness to creativity.
- For us, creativity came as a necessity. [Working on the Build and Sell project] helped our creativity.
- [My creativity was impacted] a little bit, like the cardboard project. What can you do with cardboard? There’s a lot of ideas we came up with for what we could do.

Other students felt that their creativity was not impacted that strongly in ENGR 310. Several students compared the class to another course in the Entrepreneurship Minor (ENGR 407) which students felt more strongly pushed them to be creative.

- I feel like in comparison to like the way that [the instructor for ENGR 407] taught and in comparison with the class I took with him, it wasn’t very personally creative for me. I didn’t feel that I had to think really, really hard. Because the first project you basically take a product and make it better. And there’s only so many ways to make it better. The second project was to make something out of cardboard. Basically, you look around the room trying to make things that already exist, not to try to make something that no one ever made before.
- I’d say it’s just the tip of the iceberg. Wait until you take [ENGR 407].

Table 9  
Statistics for innovation items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. I am a more creative thinker.	0	2 (9.1%)	7 (31.8%)	9 (40.9%)	4 (18.2%)	3.68
2. I often have ideas for new products or services.	0	2 (9.1%)	5 (22.7%)	8 (36.4%)	7 (31.8%)	3.91

- It kind of made you think a little bit. But it really didn’t push you that much to be creative. It was more about taking what you got and making it better.

Two survey questions tapped students’ abilities to think innovatively as demonstrated in Table 9. The results also tend to confirm the focus group results. Most of the students, approximately 60%, believed that the class helped to make them a more creative thinker.

As mentioned in the section on simulation of the entrepreneurship environment, students felt that the ability to take risks in the classroom was somewhat limited. Several students mentioned that they were already risk-takers and the class did not further enhance this characteristic. Other students mentioned that there were not very many opportunities in the classroom to take risks:

- [M]ost of us decided just to take the risk cause we didn’t have much to lose really.
- I don’t feel that I’ve taken any risks.
- We didn’t really [take risks]. Being an entrepreneur is risk-taking because it takes a lot of money.

A couple students mentioned that the class did introduce you to taking risks:

- I think for a lot of people, this class expands or helps their creative process, risk management, understand that process.
- I think it helps us to deal with a little bit better... Help you deal with taking risks better.

One survey question asked if students were more willing to take risks. The results of this item corroborated the focus group data. Half of the students (11) responded with ‘neutral’ to this item. Only about 40% agreed or strongly agreed that the class made more likely to take risks. The average of the item, “I am more willing to take risks” equaled 3.45.

Proactiveness refers to ‘acting in anticipation of future problems, needs or changes’. In order to address this process, students were asked what types of challenges they

might anticipate facing in the path to becoming an entrepreneur. Students were able to address many types of challenges, based on the experiences that they have had in the class.

- I think you kind of encounter obstacles that a lot of entrepreneurs would encounter initially.

Students mentioned different challenges involved with creating a product such as the time involved and other logistical concerns:

- I found that being the group leader, I ended up doing things more myself than to ask somebody else to do it. There were so many times that I said, this needs to get done. This needs to get done. I'm just going to do it myself. I ended up putting in more time than I ever was going to.
- With the financials, we were getting so much money. We were so excited. We were like wow, this is great. And then, we actually sat down and thought about paying each of the employees and all that stuff.
- One thing that I realized that I actually didn't know before, when you become an entrepreneur, is that dealing with people is really important... I actually learned that in class with the project.
- You really get a sense of all this stuff. You start to think about, we have to pay for this, how much is this going to cost us and things like that. How long is it going to take us to get this?

Students agreed that the types of challenges they met with in class will better prepare them for the life of the entrepreneur.

One survey question addressed proactiveness. Over 80% of the students agreed or strongly agreed with the following statement: "I feel that I can anticipate problems associated with becoming an entrepreneur." The mean for this item equaled 4.14.

Competitive aggressiveness refers to 'the tendency to directly and intensely challenge competitors'. During the focus group, students were asked how they would handle a competitor if they become an entrepreneur. Students suggested various strategies such as finding weaknesses in the product and making a better product in return. Various responses follow:

- Find his weakness and then feed off that.
- Make your product better than theirs and make it cheaper.

- Every product out there is lacking on some kind of area. Not everything is well-rounded and perfect.
- There's always something to exploit.
- There's always a market that has been overlooked. If you have a big competitor, you know what market he's working on. You know what he's working on. So basically, find what he's lacking and you just work from there.
- Give product to the public and see what they think of the product, and how to make it better. Try to understand what enhancements it would need to make it better. If the consumer sees that and knows that you're changing it to a better product, they'll probably buy from you.

Students reflected that the product dissection and redesign helped to better prepare themselves to handle an aggressive competitor. They enjoyed the competitive classroom environment involved with these projects which better simulated what could actually happen in the business world. For example, several students mentioned the benefits of these projects below:

- Actually also buying the product of your competition and studying that product [would help to challenge an aggressive competitor].
- By redesigning a product, we could really understand how to compete with a competitor to offer the same product but a better one. With the redesign project, I think it's worth a lot of ideas that you could get just from dissecting a product. It really spurs a lot of creative thinking.

One survey question addressed competition. Approximately 70% of the students agreed or strongly agreed that the class made them 'less afraid of competitors who may challenge' their ideas. This item averaged 3.95.

In order to address some other possible benefits of the class, three additional Likert-type questions were included on the survey. These were to address leadership, teamwork, and communication skills. An overwhelming majority of the students believed that they had improved their leadership abilities (90.9%), teamwork skills (86.4%), and communication abilities (81.8%). The results of these questions appear in [Table 10](#).

In conclusion, both the focus group data and the survey results tend to confirm that students are gaining the necessary skills required to be an entrepreneur. Most students felt that they were able to work well with their teams to complete the assigned tasks. They felt that the class

Table 10  
Statistics for leadership, teamwork, and communication items

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
1. This class improved my leadership abilities.	0	1 (4.5%)	1 (4.5%)	7 (31.8%)	13 (59.1%)	4.45
2. This class improved my ability to work in teams.	0	1 (4.5%)	2 (9.1%)	10 (45.5%)	9 (40.9%)	4.23
3. My communication skills have improved as a result of this class.	0	1 (4.5%)	3 (13.6%)	9 (40.9%)	9 (40.9%)	4.18

did impact their ability to be creative thinkers, although some anticipated that other courses in the minor might have more of an impact. Some students felt that they were better risk-takers, although the majority felt that the class could not quite simulate true risk. They believed that they could better understand and anticipate the challenges that arise in the path to entrepreneurship.

#### *5.4. Formative assessment concerns: what do students like/not like in the class? What needs to be changed?*

In general, students have a very positive experience in the class. Students were directly asked what they like and what they did not like about the course. One particular focus group was overwhelmingly positive about the course. As one student said “There wasn’t much not to like in the course.” Other students had some minor complaints but overall, the course seemed to be a very positive opportunity.

The textbooks used in the class did have some mixed perceptions by the students. Some students found the books to be quite helpful. They also enjoyed that one of the textbooks was available electronically, which cut down on the costs involved. Here are some responses regarding the positive perceptions of the textbooks:

- I think it was a good idea because it showed you how to structure a business plan.
- The textbook was very good I think. The way it was worded, it was directed to us, not to PhD people or masters. You would read it and you could tell that there were different writers for different sections but you could still read it relatively easily. And still get out of the material what you need. Plus the whole first half of the semester, it was a textbook that was e-mailed to us online.
- I think it’s far better than going to the Student Book Store and paying a ridiculous amount, like \$100 a book. And in this class, we did get to read it. In other classes you spend hundreds of dollars... So I think it’s a great idea that it was accessible electronically.
- I really liked the business plan book, too. I thought it was interesting to read, too. I liked how they went through each section, like they went through the company description, and marketing tactics. It’s stuff that everyone knows going into a business but they actually break it down into parts and tell you exactly. You need this company description. Here is a list of things that you need to think about. I just thought that was really helpful and easy to understand and then they included an example at the end of each section that kind of gave you an idea that you could relate to another business.
- The best thing in the book is there is no right or wrong answer... It just puts it in your head. It’s in the back of my mind. The way I react now with different people, to the teams I form, who I work with, it’s just there. It doesn’t really affect me in any way but it’s there for me to pull up if I need it.

Other students had some negative comments on the books:

- I didn’t even know we had one.
- There was a lot of redundancy... One section on leadership styles, another section on management philosophy, another section on teamwork and all of those things. If you take maybe five subjects in the book, 40% of it overlaps.
- I just think that a lot of the book was just not really worth it.
- Probably it could have been summarized in a couple sheets of paper.

Although there were some complaints about the course materials, over 50% of the students agreed or strongly agreed that the textbooks were helpful.

Perhaps most helpful to the students was the opportunity to hear entrepreneurs speak in front of the class. These experiences were overwhelmingly seen as positive to the students:

- She had entrepreneurs come in and that was awesome because we could pick their brain, find out how they got started.
- I think we should have more of those. I totally loved it.
- Just to be able to talk to more entrepreneurs. That would be a good opportunity for us. We could learn so much from people out there and see how they did it.
- I think the speakers helped us, too. Because you realize there’s nothing magical that’s going to happen to make you want to start a business. But to say, alright, I’m going to do it today. It’s just a matter of when you’re going to start. It’s going to be a risk.
- Having a guest speaker we had 2 guest speakers - it not only motivated you because you saw how successful they were with their own idea. How far they’ve gotten. It really made you understand how much they go through. How much time and effort it really takes. And how much time it takes away from their families.
- I guess just seeing the speaker there in front of us made you realize how real the class is. These people are actually doing what we’re reading about. They’re actually going through things 100 times bigger than what we’re going through right now. I think that really was a reality check for the class. Like, hey, it’s not books and theory. It’s real life.
- I think one other thing that was nice about the class is that there were two entrepreneurs that came in and gave a presentation. That was pretty helpful.

Regarding the class projects, once again, in general, students tended to have positive experiences. One concern, however, is that most students were unable to distinguish one project from the next. They seemed to group the five projects into two subsets. They tended to see the Product

Vision, Process Definition, Product Dissection, as one project. The Build and Sell was seen as a more unique and separate project. One reason for their linking may have to do with the focus on the same type of company and product. Throughout the first four projects, students were asked to focus on toothbrush and hygiene companies. One focus group emphasized that this focus on the same product began to become redundant and boring after a while:

- It was kind of boring. It was a toothbrush company. We could have done a car dealer, a car company. Maybe something that more people were interested in.
- There were a lot of toothbrushes.

The other main complaint for the projects was a lack of time provided by the instructor. In particular, students did not feel that they had enough time to thoroughly complete the Build and Sell project. Here are some of the student responses:

- We definitely didn't have enough time to go as deep as we wanted to.
- One thing I don't like about it is we're trying to make our product and at the same time we've got parts of the business plan due every week. There's just so much. We can't be working on the product and do a business plan at the same time. It takes so much out of class time.
- More time for the build and sell project. That would be good.
- My biggest gripe about the whole thing is there was a lot to do for this. We had to build materials and websites. To me, it seems like there was just way too much work to do. We started working on the business plan this past weekend. It took us the whole day. There really was a lot to do.

Students were asked about each of the individual projects. Again, because they tended to associate the first four projects together, they tended to have more to say about certain projects. The responses for each project are discussed below.

The product vision was not well remembered by the students. Students weren't overly enthusiastic by analyzing the type of company assigned. They thought that more interesting analyses might be obtained by looking at other types of companies:

- There could be like problems [when you look at another company]. Okay, this company has this kind of problem. Basically there was nothing [wrong with the companies we looked at].

The product vision was also not well remembered by the students. One student explained it to the rest of the group as follows:

- That was the one she put up on the board. It was a good exercise but I felt that it was a little too vague. A lot of us

in groups didn't know what she was looking for or what we had to do. Almost every group had a different way of doing it. That way there was no comparison. We weren't sure which group was better than the other group because everybody just did it their own way. I feel like I didn't really get too much out of that exercise.

The product dissection and redesign were much better received by the students. Students realized that these were important processes needed to become an entrepreneur and to handle competitors. Here are the comments regarding the product dissection:

- I think it was really cool. I didn't really have any experience with this. Even on a small scale as it was being a toothbrush. It was just cool to take the product apart.
- I think that activity helped us understand what really goes in a product and how we can really look at a product and decide what we can change and if we can change that then we can compete with that competitor.
- The whole reverse engineering I had [learned by doing research at a company]. Basically, that was the first time when I heard the term reverse engineering. And basically, they do that [in industry]. They have engineers who go out there, buy the competitors' products, open, reverse engineer and see why they're so successful. They ask you to build off that. The fact that we did do that in the class made me realize that wow, this class is really up to date with what's going on out there. Dissecting the product, the electric toothbrush basically did reverse engineering.

Similarly, students also had positive experiences with the product redesign:

- I thought it was good... I was surprised to find that in the six groups we had here, pretty much everyone had a completely different design for a toothbrush. You think a toothbrush, how many ways can you make it? But there was just so many different ways. Just looking at all of the designs of the product itself, we had at least 20 different types of toothbrushes. Power systems and technology. Something as simple as a toothbrush, we had so many varieties. Imagine what you can do with cars or planes. It was very eye-opening.
- By redesigning a product, we could really understand how to compete with a competitor to offer the same product but a better one. With the redesign project, I think it's worth a lot of ideas that you could get just from dissecting a product. It really spurs a lot of creative thinking.

In addition to similar complaints as the Build and Sell project regarding lack of time, students had one complaint about the project. Specifically, the students thought that

because of the product involved, the modifications done in the redesign were not very realistic:

- Main complaint, not realistic.
- I just thought it wasn't realistic. I'm not an engineer so I had no clue with what to do with it for the modifications. I just worked on the business end of it. These companies, Colgate, Braun, Oral-B, they're big companies. We're sitting there coming up with these modifications that aren't unrealistic. Obviously, if it were something that was realistic, they would have done it by now.
- They were all unrealistic.

In our case, we were given the base model, nothing special about it. Any ideas that we came up were already in a different model that they had. A more expensive model. So it was hard to come up with an idea that would actually be useful.

- Yeah, a different product would have been more work but easier. It just seems like this was so unrealistic.

The final project, the Build and Sell, also tended to have more positive reactions by the students. Again, the main concern was lack of time to complete the required tasks. Because students were working on that project at the time of the focus group, they seemed to be more concerned with the lack of time and the necessary work which had yet to be completed.

One concern regarding this final project was the assignment of students into roles of leaders or employees. When asked how they felt about these assigned roles, students seemed to be confused as to why this was done in the class:

- I didn't understand why we were doing that.
- I don't know. I didn't get what she was going at. I don't remember exactly why she did that... All the people on one side of the room went to the other side of the room.

A better explanation of the roles assigned to the students may be helpful in future semesters.

## 6. Limitations of the assessment

One potential limitation of the assessment is that there is no baseline data with which to compare the survey results. Ideally, a comparison group consisting of a similar sample of students should be asked to also complete the survey to see if the class is truly having an impact on the students. If a comparison group could not be obtained, the next solution would be to administer both a pre- and a post-survey to analyze changes over time. Unfortunately, the assessment of the course started late in the semester missing the opportunity to capitalize on early data collection. Plans are underway to collect additional assessment data,

including a pre- and post-test, in future semesters of the course. Presented assessment data will serve as the baseline comparison data for future revisions of the course.

## 7. Conclusions

Based on the assessment results, the first offering of the revised version of the Entrepreneurial Leadership course is a success. Some of the seemingly negative comments, in fact are not negative, and show the fact that the revision was on target. For example, the course was found to be less effective in stimulating creativity/innovative thinking when compared to another course (ENGR 407) within the minor. This shows the intent to not replicate other core courses' themes. The feedback provided by the students will be used to refine the course in the following areas (1) a need to relax material constraint (cardboard) used for the build and sell project, and (2) a more realistic incorporation of risk to the course. Overall, however, based on the assessment results, the planned and applied revision of the course is considered to be a success. Beyond the assessment results, there are two other results that attest to this:

- (1) All teams completing the build and sell project made profits. One team in fact made about \$700 in profit. Considering the time they were allotted to work on the project (only about 5 weeks), \$700 is a great accomplishment.
- (2) Most students taking the class, who are not graduating, decided to enroll in the Entrepreneurship Minor.

This paper aimed to share the outcomes of the implemented changes to the course as an avenue for entrepreneurship educators to learn from others' experiences, and to contribute to the entrepreneurship education literature. As such it can be concluded that with the current content and the project-based teaching style, the course accomplished:

1. facilitating knowledge and skill development in the areas of leadership, motivation, innovation, communication skills, teamwork and writing business plans, and
2. developing knowledge and skills in ways that encourage entrepreneurial behavior.

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## Appendix A. Focus Group Protocol

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Introduction	1. Let's start off by going around the room and stating our names and majors.
Positive experiences of course	1. Let's first talk about the positive experiences you may have had in the class. What do you like about the class so far? 2. What benefits do you see from this class? a. Creativity/ability to think innovatively? b. Risk-taking?
Simulation of entrepreneurship	3. How has this class simulated the 'life of the entrepreneur?' a. Do you have a better understanding of what it takes to become an entrepreneur? b. Do you think that you will become an entrepreneur? c. What types of challenges do you need to anticipate when starting your own business or company? d. Say you are starting your own business, how would you handle an aggressive competitor?
Teaching style	How do you feel about the style of teaching that was used in the class? a. Do you feel that the class used a more 'active' style of teaching?
Class projects	5. What did you like about the class projects? What didn't you like about the projects? a. Product vision b. Process definition c. Dissection d. Product redesign e. Build and sell product 6. It sounds like some of the projects were more unstructured in nature than projects in your regular engineering classes. When you were encountered with a situation or project that didn't have a lot of direction, what did you do? a. Did you go to others for help? Did you rely on instinct/feelings? Why?
Other things about the class that need to be changed?	7. How do you feel about the textbook and course materials used in the class?  8. What (else?) didn't you like about the class? 9. What should be changed for future semesters?
Summarize	10. Summarize the proceedings. Ask if there are any other comments about the class.

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## Appendix B. Background questionnaire and likert-type scale

Major: \_\_\_\_\_

Minor (if applicable) \_\_\_\_\_

Semester standing: \_\_\_\_\_

Future career goals: \_\_\_\_\_

Why did you decide to take this class? \_\_\_\_\_

Are you planning to complete the E-SHIP minor? Why or why not? \_\_\_\_\_

Think about the EFFECTS of ENGR 310. Please place an X in the appropriate box to respond to the items using the following scale:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

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As a result of this class...	1	2	3	4	5
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1. I better understand what it takes to become an entrepreneur.
  2. I better understand what starting my own company would be like.
  3. I have a better understanding of what an entrepreneur does.
  4. I am a more creative thinker.
  5. I now believe that it is possible for me to be an entrepreneur.
  6. I can better see myself starting my own business or company.
  7. I can more easily make decisions independently.
  8. I am more likely to rely on my gut feelings and instincts than advice from others.
  9. I often have ideas for innovative products and services.
  10. I am more willing to take risks.
  11. I can anticipate problems associated with becoming an entrepreneur.
  12. I will be less afraid of competitors who may challenge my ideas.
- 

Think about your PERCEPTIONS of ENGR 310. Please place an X in the appropriate box to respond to the items using the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Neutral
- 4 = Agree
- 5 = Strongly Agree

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	1	2	3	4	5
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1. I enjoyed the active learning style used in this class.
  2. The teaching style used in this class matches my preferred learning style better than most other classes.
  3. My team was able to complete the projects independently.
  4. This class simulates what it's like to be an entrepreneur.
  5. The textbook used in class was helpful.
  6. I developed a trusting relationship with my team.
  7. This class improved my leadership abilities.
  8. I hope to continue to work on the ideas/projects that originated in this class.
  9. This class improved my ability to work in teams.
  10. My communication skills have improved as a result of this class.
- 

## References

- Clark, D., 2001. Leadership, [http://www.nwlink.com/\(donclark/documents/leadershipshareware.html](http://www.nwlink.com/(donclark/documents/leadershipshareware.html).
- Cresswell, J., Plano Clark, V.L., Gutmann, M.L., Hanson, W.E., 2003. Advanced mixed methods research designs, in: Tashakkori, A., Teddlie, C. (Eds.), *Handbook of Mixed Methods in Social and Behavioral Research*. Sage Publications, Thousand Oaks, CA, pp. 209–240.
- Curran, J., Stanworth, J., 1989. Education and training for enterprise: Some problems of classification, evaluation, policy and research. *International Small Business Journal* 7 (2), 11–22.
- Davies, L.G., Gibb, A.A., 1991. Recent research in entrepreneurship. The Third International EIASM Workshop, Gower.
- Eggert, N., 1998. *Contemporary Leadership for Entrepreneurial Organizations: Paradigms, Metaphors and Wicked Problems*, Quorum, Westport, Connecticut.
- Garavan, T.N., O'Conneide, B., 1994. Entrepreneurship education and training programmes: A review and evaluation—Part 1. *Journal of European Industrial Training* 18 (8), 3–12.
- Gibb, A.A., 1987. Enterprise culture - Its meaning and implications for education and training. *Journal of European Industrial Training* 11 (3), 3–38.
- Gorman, G., Hanlon, D., King, W., 1997. Some research perspectives on entrepreneurship education and education for small business management: a ten-year literature review. *International Small Business Journal* 15 (3), 56–77.
- Hills, G.E., 1988. Variations in university entrepreneurship education: an empirical study of an evolving field. *Journal of Business Venturing* 3, 109–122.
- Hindle, K., Cutting, N., 2002. Can applied entrepreneurship education enhance job satisfaction and financial performance? An empirical investigation in the Australian pharmacy profession. *Journal of Small Business Management* 40 (2), 162–167.

- Hood, J.N., Young, J.E., 1993. Entrepreneurship's requisite areas of development: A survey of top executives in successful entrepreneurial firms. *Journal of Business Venturing* 8 (2), 115–135.
- Knight, R.M., 1991. A proposed approach to teaching. *Journal of Small Business and Entrepreneurship* 9 (1), 43–54.
- Kourilsky, M.L., Walstad, W.B., 1998. Entrepreneurship and female youth: Knowledge, attitudes, gender differences, and educational practices. *Journal of Business Venturing* 13 (1), 77–88.
- Lumpkin, G.T., Dess, G.G., 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of Management Review* 21, 135–172.
- McMullan, W.E., Long, W.A., 1983. An approach to educating entrepreneurs. *The Canadian Journal of Business* 4 (1), 32–36.
- McMullan, W.E., Long, W.A., 1987. Entrepreneurship education in the nineties. *Journal of Business Venturing* 2 (3), 261–275.
- Northouse, P.G., 2004. *Leadership: Theory and Practice*. Sage Publications, Thousand Oaks, CA.
- Rzasa, S.E., Wise, J., Kisenwether, L., 2004. Evaluation of entrepreneurial endeavors in the classroom: The student perspective. Paper presented at the annual meeting of the National Collegiate Inventors and Innovators Alliance, San Jose, CA.
- Schulz, W.C., Hofer, X., 1999. *Creating Value Through Skill-Based Strategy and Entrepreneurial Leadership*. Pergamon, New York.
- Sexton, D.L., Bowman, N.B., 1984. Entrepreneurship education suggestions for increasing effectiveness. *Journal of Small Business Management* 22 (2), 18–25.
- Sexton, D.L., Kasarda, J.D., 1991. *The State of the Art of Entrepreneurships*. P.W. Kent Publishing Co, Boston, MA.
- Smilor, R.W., Sexton, D.L., 1996. *Leadership and Entrepreneurship: Personal and Organizational Development in Entrepreneurial Ventures*, Quorum, Westport, Connecticut.
- Strauss, A., Corbin, J., 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Sage Publications, Thousand Oaks, CA.
- Teddle, C., Tashakkori, A., 2003. Major issues and controversies in the use of mixed methods in the social and behavioral sciences, in: Tashakkori, A., Teddlie, C. (Eds.), *Handbook of Mixed Methods in Social and Behavioral Research*. Sage Publications, Thousand Oaks, CA, pp. 3–50.
- Ulrich, T.A., Cole, G.S., 1987. Toward more effective training of entrepreneurs. *Journal of Small Business Management* 25 (4), 32–39.
- Vesper, K.H., 1982. Research on education for entrepreneurship, in: Kent, C.A., Sexton, D.L., Vesper, K.H. (Eds.), *Encyclopedia of Entrepreneurship*. Prentice hall, Englewood Cliffs, NJ.
- Wise, J., Kisenwether, L., Rzasa, S., 2003. Assessing engineering entrepreneurship. Paper presented at the annual meeting of the American Society of Engineering Education, Nashville, TN.

**Gül E. Okudan** is an Assistant Professor of Engineering Design at The Pennsylvania State University. She has been teaching engineering/product design and various entrepreneurship courses since 2000. She holds a PhD in Engineering Management from University of Missouri-Rolla, a MBA from Istanbul University and a MS in Industrial Engineering from Yildiz Technical University in Turkey. Her research interests include manufacturing strategy formulation, product design team performance, design cognition, and entrepreneurship/engineering education.

**Sarah Rzasa** is a Teaching and Learning Assessment Specialist at the Schreyer Institute for Teaching Excellence at Penn State University. She has received her Masters degree in Educational Psychology at Penn State where she specialized in applied measurement. She is currently a doctoral candidate in the same program. Her interests include the utilization of mixed methods designs into the test development process and in classroom assessment.