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AN UG COURSE FOR BUSINESS +
ENGINEERING STUDENTS**

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PRODUCT CONCEPT TO COMPLETE BUSINESS PLAN IN THREE MONTHS IN UG COURSE FOR BUSINESS + ENGINEERING STUDENTS

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ABSTRACT

In the first course of the Business-Engineering-Technology (B-E-T) minor, Auburn University, sophomores/juniors work in multi-disciplinary teams to conceive and select a technology-intensive product, develop a project schedule, conduct market research and survey, complete product engineering/design, make manufacturing/sourcing decisions, estimate demand for five years, develop production/sourcing capacity, estimate investment needed and 5-yr cash flow as part of a business plan in 3 months; the business plan presentation is judged by a panel. The course is called Introduction to Business and Engineering but it is a holistic Technology Ventures course that prepares engineering and business students to partner together in bringing a technology-intensive product to the market. *This course can be easily adopted by any university.*

Key words: Pedagogy, Teaching, New Venture Creation, Business Plan Development, New Product Development

INTRODUCTION

The B-E-T minor is offered jointly to business and engineering students at Auburn University. It is a 16 semester-credits minor that includes seven custom-designed courses for business and engineering students preselected into the program--admits 40 each February for the class entering in fall of the year.

The first course made of sophomores and juniors work in multi-disciplinary teams to conceive a product, develop a project schedule (using MS Project software), conduct market research and market survey, complete product engineering/design, make manufacturing/sourcing decisions,

estimate demand for five years, develop production/sourcing capacity, develop cash flow and financials for five years, and complete a business plan including all the above in three months for presentation to a panel of judges. The judges may come from both colleges or from industry for the final presentation by the teams, who also are expected display their project in posters and their products in models or prototypes.

The engineering content of the products are high because the teams have engineering students, and the marketing and financial aspects are well covered by business and engineering students. There are mini-modules of lectures from several different business and engineering professors to help students proceed with their projects. Typical modules cover electrical engineering, energy conversion, material science, marketing, accounting, and financing a startup.

The course is taught jointly by a Professor of Operations Management from the College of Business and a Professor of Mechanical Engineering from the College of Engineering.

COURSE DELIVERY

Exhibit 1 shows that the backbone of the course is a project that is paced by a tight schedule to complete the many components of a business plan by the end of the semester. This is the tool to ensure timely completion by a multi-disciplinary team from business and engineering students. The team is constituted by the teachers ensuring a blend of business and engineering students. If teams have problems, it becomes evident in the early stages of the team assignments; team members evaluate each others' contribution as part of each project report due in every stage of the project. If a team member is marked down, the teachers meet the team to ensure that the team is not suffering from teamwork problems. When the teachers detect such problems, the teachers counsel the teams and have always succeeded in getting the teams to complete the project on time and with a workable relationship within a problematic team.

Students have said how the final report flows naturally from all the many parts of the project they are required to do before the final project report and presentation.

ASCERTAINING COURSE VALUE

Two different perspectives about the course are presented here for ascertaining its value. First are comments from different judges, who have had the chance to be part of the judges' panel at the end of the semester, fall 2009.

The opinion of judges

Dr. DiPofi, the Director of the Small Business Administration, Auburn University, one of the external judges, states:

"As a judge of the business plan in 3510, I observed that these students exhibited a maturity in their learning as they explained taking an idea, a mere thought, and designing

a product and building a business around that idea. They moved through the process of need identification to product design to organizational and financial development. Employer-desired skills were developing at a rapid pace in this program."

Dr. Andrew McLelland, Professor of Accountancy, with industrial experience; another judge, has this to say:

"I have worked as both a judge (2 years) and two day instructor (3 years) on cash flows and accounting for BUSI/ENGR 3510. Each year I am impressed with the innovative ideas the students develop during the fall term. These ideas are then advanced from both an engineering and business perspective until the final business plan is delivered. One year a group of these bright students developed a new electricity transmission tower and several representatives of Alabama Power came to the final presentation."

Dr. Danny Butler, Associate Professor of Marketing, with experience in marketing of new products, has this to say:

"I was a judge for the 3510 course. In a very short time students were able to conceptualize difficult problems, develop sound technological solutions and develop a basic business process for a product with potential demand and market. These projects are not ready to launch but they are ready for stage two development and further analysis as you would find with any sound business planning process. I strongly believe it is the concept of cross-fertilization of domains (i.e., business with engineering and technology) that allows these students to move quickly from a blank slate to having a good understanding of the theory and the application of developing technology-intensive products and their subsequent commercialization."

Value to courses that follow

The second approach to ascertaining the value of the class experience in this first course of the minor comes from the teachers of the next course in the sequence of courses required for the minor; i.e. course number 3520 following the first course 3510. The seven course sequence is custom designed for developing teamwork skills and business plan development skills over a period of four semesters or two calendar years. We believe many of the skills such as teamwork and business plan development take considerable time for development; one semester is inadequate.

The teachers of the next course, Dr. Raju and Dr. DiPofi, have designed projects that build on the skills developed in the first course. A large local manufacturer, Michelin North America, who closed business, has provided venture capital for new businesses. The student teams were asked to prepare proposals for submission to this venture fund using the format provided by the fund.

The assignment described in the words of one student:

"Since Michelin closed the plant in Opelika, AL, they decided to help create jobs in the area to replace the ones that were lost. They want to assist the advancement of economic

development projects with a loan program. The loans start at \$10,000 at a prime rate through a local ... Bank. When the businesses receive these loans they have an understanding that they will repay the loan back in five years.” (Student ST).

The instruction to students included:

“Write one page summary comparing the business plan model used in BET 3510 with the Michelin Fund’s model/template. Write one page explaining what you learned from this process.”

Students were asked to keep an electronic journal that is accessible to the professors. Here are some student comments about their experience with business plans they developed for submission to the Michelin Fund:

1. The Michelin business plan was also the first business plan that I have written to real potential investors. The other business plan that I did last semester was for fictitious potential investors. This semester, I was able to see how some business plans are done in the real world. It is nice to be able to see that what I was doing last semester, as well as this semester, apply to real world situations. Many times, classes are very different from what actually happens in industry, but through this project, I learned that what I have been doing in my classes is the same as what happens in the real world (student GM).
2. Another lesson that I learned had to deal with the loan amount asked for in our business plan. In our previous business plan in 3510, the loan amount could be anything that we desired necessary. In the Michelin model, it forced us to consider a smaller loan amount. Having to do this altered our cash flow statement in many ways. It allowed me to learn more about the effect sales, expenses, and cost have on a cash flow statement in a business plan. We had to change our sales to reflect the lower loan amount we were asking for. We also had to change some of our expenses and be more frugal with what we bought to operate our business effectively. The cash flow is the most important part of any business plan. Therefore, it is very helpful to become more familiar and comfortable with cash flow statements. The market overview is a very important part of making a business plan. As an engineer, I have to make an effort to consider the marketing and financial side of developing a business. I have been able to learn the importance of marketing and how to market a product effectively. The more I am exposed to these financial statements and marketing tactics the more I learn about how to operate a business effectively (student, GM).
3. I was pleased to see how my experience with last semester’s business plan had translated into the Michelin project...The experience of developing a business plan and evaluating all the relevant expenses and obligations of doing so will inevitably benefit me in my future career. I have learned that, although my major is finance and most of my projected jobs are business related; I enjoy the engineering and technological side of the project just as much, if not more. I have also begun to refine my role in team setting and where my strengths and weaknesses lie (student, DM).
4. Michelin Loan Application – Very useful to my future career (student JN).

A sample of student comments in the journal reproduced above shows that they are able to recognize the skills from the first semester that they bring to real-life settings in the second semester. It is notable that students are able to identify what they have learned from the two courses (the electronic journal entries are from spring 2010 course). In the third and fourth semesters of the program, they will develop, in teams, a more extensive product and business plan as part of their capstone experience. Some teams will work with team members in the UK or India.

The opinion of teachers

Several teachers in the B-E-T Program comment on the value of the first course and how it provides a seamless experience to our students over multiple semesters.

“Knowing the 3510 students had business plan experience behind them, as an adjunct professor for 3520, I was able to reinforce key learning points from that experience by using examples, comparing and contrasting, from their own previous work.” (Dr. DiPofi, teacher in the second semester).

“Having the intro course taught as a buffet of topics yet tied together by lead instructors develops students faster than the time it normally takes. Students have a stronger foundation and more realistic idea of what it takes to commercialize technology. Without a foundation course like this, students would not have the breadth and depth to really tackle the next level of courses (Dr. Butler, teacher in the third semester).

CONCLUSIONS

With the help of three teachers from the College of Business, four from the College of Engineering, and one from the College of Pharmacy (leadership course; 1 credit), the minor is able to give to business and engineering students a unique learning experience in developing technology-intensive products and teach them the process of commercializing them by marketing them as income-producing investments to potential investors. We need more of this training across this country. Our four-semester sequence is a luxury we can afford due to generous gifts to the B-E-T Program, Auburn University. However, the first course that we describe here is an adequate prototype for implementation in any university with colleges of business and engineering willing to work together for the good of their students and the economy. The first course is a stand-alone course that captures the essence of the four semesters of learning in one semester. We would like other universities to try and adopt this first course. This is an excellent course on technology ventures; it is not the garden-variety entrepreneurship course—as we say, not another “chicken wing” business. The course requires a technology-intensive product at the heart of it and uses and exploits engineering talent in each team.

Exhibit 1: Class project components and final report due dates

Parts of the project	Due	Grade	
1. Part 1: You team will select a product from a sample provided. Disassemble it, prepare clear engineering description of the product, drawing, how it works, its specifications and specification of its parts. Use form provided.	Aug 31M	5 % presentation	
Each team to propose 2 or 3 products for their project; energy saving product, any “green” product, products that recycle materials, products for the poor, products for the handicapped, or other.	Sept 9W	No grade but for teachers to give feedback	
2. Part 2: Prepare a preliminary project schedule and turn it in. MS Project recommended. Use it to guide your team during the semester	Sept 9W	5 % no presentation	
3. Term Project Part 3: PROPOSED MARKET SURVEY AND ANALYSIS—Use the survey to improve your product features and functions. Report and peer evaluation due	Sept 23W	5 % presentation	
4. Term project Part 4: RESULTS OF MARKET SURVEY, AND MARKET RESEARCH— CONCLUSIONS FROM THE MARKET SURVEY. WHAT WOULD BE YOUR PRODUCT FUNCTION, FEATURES, ETC. Due: Report and peer evaluation due	Oct 5M	5 + 5 % presentation	
5. Term Project Part 5: PRODUCT, MAJOR COMPONENTS AND TECHNOLOGIES NEEDED and HOW THE TECHNOLOGIES WILL BE ACQUIRED—keep the product simple, no more than 5-10 components—indicate material used, shape, drawings, how would you produce key parts, make or buy?--Report and peer evaluation due	Oct 26M	10 % presentation	
6. Part 6: Cash flow projection for five years for your new company—first estimate demand each year, production each year, direct and indirect costs and investment needed, profits or loss at the end of each year, cumulative net cash flow each year, etc.	Nov 16M	5 % no presentation	
7. Part 7: Final report: Required--A business plan--marketing plan, market research, conceptual design, detailed design, organization of the company, staff, how much to produce for five years, production and procurement, cost of manufacturing, estimated cost and cash flow for five years, financing the business as a stand alone new company, etc. Final report and presentation. Include worksheets from the text as needed. – you may see a sample business plan at the BET offices, or posted on web pages.	Report due presentations Display exhibit Dec 2W	40% (15 for the report, 5 for presentation; 10 for exhibit; 10 for Appendixes I, II and III)	
	Total	80 % course grade	