

## Resources for Working with Sponsors in Course-Based Projects

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**REQUEST FOR PROPOSAL****Café Lotta**

Café Lotta has several coffee shops located in and around Worcester. The shops sell a variety of baked goods and coffee beverages. There are 4 secondary locations and one central "office" location. All the main business functions are handled in the home office. Café Lotta's *Mission* is to create a complete café experience for our customers by providing a relaxed, "homey" feeling where friends can get together to talk, but still allow others to find a sanctuary of solitude.

We have a mix of customers such as students, faculty, and staff of several local universities, as well as, professionals and others. Some come in to grab a quick cup of joe, while others like to have longer meetings and grab coffee and food.

**A network design for our new network overhaul:**

- The main Café Lotta building will consist of one small central office building and store location. The other 4 are stores.
- The network must connect all stores to the central office.
- We require a reliable network that supports the **secure** transfer of all data.
- Secure connection to the internal network from home for managers and selected staff desired.
- You must provide design services, cost information, and justification for all hardware/software selections.
- Our customers expect their information to be safe and secure and we want the network to assist us where possible in ensuring all our customers information is safe.
- We have an iphone and android app that allows customers to pay and log loyalty points. We also have a website that must be available to the public.
- We are interested in combining our computer and phone lines (IP TELEPHONY) in the new buildings and would like to get your recommendation on this.
- Since we are looking to expand, we need you to consider network growth and innovative, yet cost effective ways of expanding our network.
- INNOVATIVE SOLUTIONS TO OUR NEEDS ARE ENCOURAGED.

This request for proposal seeks a network vendor that will provide Café Lotta with the best network at a reasonable price.

**Available Staffing and Building Specs:**

The main building will be a one-story building with approximately 1,500 square feet. This includes a 800 square feet for the store located at this site. Our other stores are approximate 800 square feet each. You will be able to run all network cables before the floor and ceilings are completed. Construction will start in September 2016, and be completed by August 2017. We move in October 2017. Please adjust your installation schedules according to these dates.

Floor Plans are not available yet, but here is some additional information that may help.

- There are 2 full-time workers (one manager and one assistant manger) and approximately 10 part-time workers at each coffee shop, who can work at different locations if needed.
- Each store has a:
  - Seating area, where customers can sit an enjoy their drink or food.
  - Order area where customers order.
  - Barista area, where customer drink orders are prepared.
  - Counter area, for food showcase and handing out orders.
  - Storage area for extra inventory.
- The main office has the same space for their store with additional storage and office space for owner, accountant, and 3 office helpers.
- IT help is currently outsourced and a new vendor is an option.

Assumed breakdown of the stores: be sure to include expected hardware devices will be utilized in each area (i.e., computers, printers, etc.). Each location will have a closet suitable for wiring and equipment.

Please provide a comprehensive network plan including multi-year support and recommendations for IS staffing. We will need a breakdown of staffing, building expenses, and other costs. Given the state of the economy, we are looking for a *reasonably* priced plan that will support our current needs and some future growth.

Our new buildings will be located near Worcester, Massachusetts.

**WE INVITE YOU TO CONTACT US TO DISCUSS THESE REQUIREMENTS.**

Contact: E. Loiacono at [eloiacon@wpi.edu](mailto:eloiacon@wpi.edu).

**(Note this is a greenfield opportunity, so you are not constrained by previous building requirement, etc.)**

# Work In Progress - Encouraging Innovation by Having Students Develop their Own Course Design Projects

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**Abstract** – Project based design courses incorporating realization have an important role in the education of engineering students. Instructor supplied design projects allow students to develop creative solutions. However, these projects largely bypass or eliminate the innovative part of the design process related to recognizing and developing the need for the design. In 2008 the format for an intermediate level design course was changed so that the student teams became responsible for developing their own design projects. In addition, team members became individually accountable for different phases of the project. Some refinements to the format were introduced in 2009. A typical project statement is to ask students to design a new device to assist elderly persons with a disability. The resulting student developed projects have been of high quality and it has been recommended that several of the groups file invention disclosures with the university. Student course evaluations strongly support this new approach.

*Index Terms* – Design projects, Creativity, Innovation, Entrepreneurship.

## INTRODUCTION

The pedagogical benefits of hands-on design projects are well established. Course formats which integrate design projects and lectures enable students to actively follow the design process through constructing and evaluating a working prototype [1]. Identifying suitable design projects that fit into a single course format can be quite challenging. While instructor generated projects allow students to develop creative solutions, that same format eliminates the innovative part of the design process that first identifies and evaluates the problem that needs to be solved. Insuring that student teams have a sufficient breadth of skills for completing the project as well as establishing individual accountability can also be problematic. This paper describes a new approach that has been used for the past 2 years in an intermediate level design course. The students first form teams based upon skills and leadership interests. The student teams then develop their own design projects by identifying a problem in need of a solution and then creating, constructing and evaluating a first generation prototype of a device that addresses that need.

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## METHODS

Rehabilitation Engineering (ME 3504) is offered annually and focuses on realization through a course design project. Enrollment is approximately thirty 3<sup>rd</sup> and 4<sup>th</sup> year mechanical and biomedical engineering students who have completed an introductory design course. Prior to initiating this new approach, the instructor solicited multiple design projects from organizations that provide services to persons with disabilities. The students self assembled into 4 person teams and 2-3 teams worked on the same project [2].

Two major changes were introduced in 2008. First, a formal means of creating student teams was introduced using a company based model that had been recently developed [3]. During the first 2 class periods students interview before the entire class for one of 4 company positions; Chief Executive Officer, Chief Technical Officer, Chief Information Officer and Chief Manufacturing Officer. The students then form 4 person company teams where each student takes on the role of a specific officer. Approximately 30% of each student's grade is based upon how well he/she fulfills their officer role. The instructor and teaching assistant play the role of venture capitalists who are investing in the individual companies. Each officer must prepare and present reports at periodic design reviews. Second, the responsibility for identifying the specific design projects was changed from the instructor to the student teams. The team assignment for the 7<sup>th</sup> class is to develop a formal proposal and oral presentation to create a new device to aid persons with disabilities or to create a significant improvement of an existing device. The proposal must establish the need for the device and benchmark existing products. Background research must cite relevant patents as well as both practical and scholarly articles that relate to the use and/or need for the device. The proposal must also contain a rough budget for construction of the prototype with prices sourced from catalogs and suppliers. Finally the team must propose a time line for executing the project.

## RESULTS

This section describes the results from the first two years of using the new format. The first offering revealed some unanticipated issues that needed to be addressed.

October 27 - 30, 2010, Washington, DC

*I. First Offering (2008)*

Seven teams undertook design projects on a wide variety of topics. Project topics included a hands free dental hygiene system, an improved page turner, a lightweight portable seating system for bleachers, two types of improved walkers, and 2 projects involving wheelchair accessories.

Two issues arose that had not been completely anticipated. The instructor had prepared a backup list of projects in the event that some of the student proposals could not be fully developed within the time or budget constraints of the course. However, the two teams that pursued one of the instructor supplied topics felt that they were at a disadvantage relative to the rest of the class because they had switched topics. The option of an instructor supplied topic was eliminated in 2009.

An advantage of having multiple design teams work on the same project is that it reinforces the concept that there are multiple successful solutions to a design problem [2]. The impact of the final oral presentation on the other design groups seemed to be lessened by the lack of commonality between the various design problems. Additionally, the project areas were so diverse that the course lectures could not effectively relate to all areas.

*II. Second Offering (2009)*

In 2009 an effort was made to create some common elements between the student developed topics by requiring that the projects fall into one of several areas. Two of the project areas were very general;

- To develop a new toy for children with disabilities that is operated by a single switch.
- To develop a new device to assist elderly people with disabilities.

Two other areas were more specific and were presented to accommodate those teams that felt the need for a more defined project topic. The majority of the teams chose to develop projects in the two general areas.

A design team that undertook development of the new toy first researched the importance of play as it pertains to emotional, social and cognitive development. Based upon their research and benchmarking, they decided to design a compressed air powered mechanism that can adapt easily to any wheelchair and can “throw” a ball by activating a switch commonly used by persons with disabilities (Figure 1).

Another team undertook developing a new device for the elderly and focused on the difficulty that elderly persons experience getting into and out of bed. They developed the “Bedroom Buddy” which attaches to a plywood sheet placed beneath the mattress and provides a swing away support for entering and exiting the bed.

Project results in 2009 were of sufficient quality that in 3 cases the instructor recommended that the student teams file invention a disclosure with the university. The same course format will be used in 2010.



FIGURE 1  
SINGLE SWITCH ACTIVATED BALL THROWER.

**DISCUSSION**

The change to student developed design projects was introduced simultaneously with implementation of company based design teams. These two changes are complementary in terms of increasing student motivation. Freedom to select their design project increases student autonomy. Using company based teams, coupled with the ensuing role playing, provides relatedness between the team members. Design reviews provide both a challenge to each team member as well as an opportunity for effective feedback. Contextual conditions that facilitate competence, autonomy and relatedness have been shown to facilitate intrinsic motivation [4]. Not all students are entirely comfortable with a completely open ended project topic. Thus there is a need to provide one project area that is somewhat more defined. In 2009, this latter problem was to design a new type of storage drawer for mounting under a wheelchair tray. Course evaluations indicate that the students strongly support this new format and have increased their time commitment to the course.

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## Encouraging Innovation by Having Students Develop their Own Course Design Projects

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## Disadvantage of Instructor Developed Projects

Eliminates the innovative part of the design process that identifies the problem and establishes the need for the solution.

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## Introduction

- Typical educational goals for course design projects include:
  - Development of creativity
  - Application of technical knowledge
  - Manufacturing and prototyping skills
  - Testing and Evaluation
- Oral and written communication
- Group management

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## ME 3506 Rehabilitation Engineering

- Project based design course lasting 7 weeks (35 meetings).
- 3<sup>rd</sup> & 4<sup>th</sup> Year ME & BME students.
- Enrollment ~ 30 students.
- Teams must develop the project.
- Expected to design, construct and evaluate a working prototype.
- Projects relate to the development of assistive technology.

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## Advantages of Instructor Developed Project Topics

- Can be clearly coupled to course lecture material.
- Project topic areas are bounded and more easily managed.
- Multiple teams can work on the same project.
- Oral presentations show multiple acceptable solutions.

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## Formation of Project Teams

(Step 1)

- Form teams based upon the role of company officers.
  - Chief Executive Officer (CEO)
  - Chief Technical Officer (CTO)
  - Chief Information Officer (CIO)
  - Chief Manufacturing Officer (CMO)
- Instructor and teaching assistant play role of venture capitalists (Vcs) funding the companies.

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### New Format

- Course requires 2 progress reports be submitted to the VCs.
- Followed by 20 minute oral design reviews which begin with a detailed status report from each officer.
- Teams receive a budget but VCs will "invest" a higher level in more promising companies.

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### Develop Project Proposal

(Step 2)

- Establish the need for a new product or a major improvement to an existing product
  - Benchmarking existing products
  - Search relevant patents
  - Review practical and scholarly articles
  - Create a rough budget
  - Establish a project time line
  - Due on 7<sup>th</sup> class period

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### 1<sup>st</sup> Offering (2008)

- 7 projects - hands free dental hygiene system, portable stadium seating, improved walkers and wheelchair attachments.
- 2 teams proposed projects that could not be completed within the course and were given a backup project developed by the instructor.

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### Evaluation (2008)

- Outcomes were generally successful.
- Project topics were too diverse.
- Course lectures could not effectively relate to all projects.
- Impact of final oral presentations was lessened by the lack of commonality between the projects.
- Students who switched topics after the proposal felt disenfranchised.

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### Results - Subjective

- Most teams seemed to enjoy the role playing.
- Several teams came to design reviews in professional attire with a clear goal of showcasing their company.
- Many teams use the design reviews to ask probing questions of the VCs.

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### 2<sup>nd</sup> Offering (2009)

- Two very general project topics
  - Develop a toy for children with disabilities that can be operated by a single switch.
  - Develop a device to assist elderly people with disabilities.
- Two more specific project topics
  - Design a new type of storage drawer to be mounted beneath a wheelchair tray.

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**3rd Offering (2010)**  
 Same two general problem statements (6 groups)  
 One more specific problem statement (1 group)

Stair Climbing Assistant      Grab-Bot



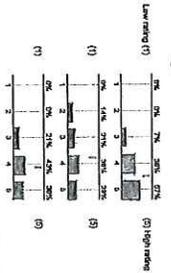
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**2010 Course Evaluations**

Q1 Defining your project topic (4.4)  
 Q2 Company officer design team (3.8)  
 Q3 Oral design reviews with VCs (4.2)



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**Discussion**

- Two complementary format changes were introduced simultaneously
- Self reported student time commitment to the course has increased
- There is a need to provide one project topic that is more instructor defined.

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**Summary**

- The development of the new format has been a Work-In Progress which after 3 years is now approaching a steady state.
- Future efforts will be directed at obtaining more detailed student feedback.

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