OPIM 415/MEAM 415: Product Design
Spring 2003

Instructor:
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Department of Operations and Information Management
University of Pennsylvania
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Class Logistics:
Tuesdays
3:00 – 6:00pm
Huntsman Hall F65

Teaching Assistant:
TBD

WebCafe Site:
http://webcafe.wharton.upenn.edu/eRoom/opim/415-sp03-1
You will need a Wharton account to access WebCafe. Please visit http://accounts.wharton.upenn.edu to obtain an account, if you do not have one.

Workload:
This course is designed to require an average of six hours of work outside of class each week although there is some variability week to week.

Course Materials:
The textbook for the course is:

Other readings for the course are available on WebCafe or will be distributed in class.
Learning Contract

I will:
- Apply care and effort in preparing and leading 14 sessions.
- Demonstrate flexibility and responsiveness to student concerns and suggestions.
- Provide next-session feedback on assignments.
- Design the workload to average 6 hours per week outside of class.
- Respond to email within one work day.
- Start and end class on time.
- Learn student names.

You will:
- Prepare for each class session.
- Miss no more than one class session.
- Allocate an average of at least 6 hours per week outside of class for preparation and assignments.
- Arrive for class on time.
- Sit in approximately the same seat each session, when possible.
- Use your name card.

Intended Benefits of Course

- Development of skill with tools and methods for product design.
- Understanding of multiple functional roles (e.g., marketing, industrial design, engineering) in creating a new product.
- Development of ability to apply specific knowledge from SEAS/Wharton curriculum in a realistic industrial context.
- Development of confidence in own abilities to create a new product.
Project Mission Statement

Assume you work within a company with a strong focus on lighting products (e.g., Zelco, http://www.zelco.com). Your senior management has discovered that the new high-output LEDs available in the market offer many benefits, including high efficiency, robustness, and long life. Your team has been asked to identify a product opportunity in the category of “low power lighting” that takes advantage of these LEDs. Given your expertise and knowledge, you’ve been asked to create a product for the university student market.

Some existing products:
Grading and Assignments

- Grading serves essentially only one pedagogical function: students are much more likely to complete the readings and preparation questions if this work is graded. Students who prepare better, learn better.

- Your final grade is based on class participation (25%), the quality of the individual project assignments (25%), the estimated profitability of your final product (30%), and your teammates’ assessment of your contribution to the project (20%).

- There are no exams in this class.

Class Participation

- I grade class participation each day after class based on the extent to which comments reflect preparation, analysis, and thoughtfulness. You can facilitate this process by using a name card and sitting in the same location each day. Although this process is subjective, it is highly reliable, as your grade is based on lots of data.

- Students will be cold called in most class sessions. Cold calling is random and inconsistent. Do not rely on cold calling as your primary vehicle for class participation.

Assignments

- You are to complete the preparation questions for every class session, otherwise you will not learn the material.

- All project assignments are due in your webcafe project folders before the beginning of class. Late work is not accepted.

- Under no circumstances should you add cover sheets, tables of contents or other fluff to your assignments. This practice is wasteful, cumbersome, and annoys rather than impresses.
1. Introduction and Opportunity Identification
Tuesday, January 14

REQUIRED
1. 3,000 Ideas = 1 Commercial Success (WebCafe)
2. U&E Chapters 1-2
3. U&E Chapter 3, p. 50-53 “step 4” on “mission statements”

SALSA
1. Why P&G’s Smile is So Bright (WebCafe)

MORE (optional)
1. Rest of U&E Chapter 3.

PREPARATION QUESTIONS
1. Was the SpinBrush product described in the P&G article the result of “market pull” or “technology push”?
2. What do you think explains its success?
2. Customer Needs  
Tuesday, January 21

REQUARED  
1. U&E Chapter 4

HAND IN  
1. Your one-page opportunity proposal. [Turn this in to the “Hand In” folder on WebCafe and bring hardcopy to class as well. This is the one assignment that you must hand in in hardcopy form.]

PREPARATION QUESTIONS  
1. Generate a list of at least 10 market opportunities for a low-power lighting device for students.  
2. Evaluate these opportunities and pick one that you could pursue for this class.  
3. Prepare a one-page opportunity proposal. The top-level description of the opportunity must not violate the “what not how” principle (I.e., what is the need….not how might you address the need.) This proposal should include:  
   ▪ A mission statement as in Exhibit 3-10 in U&E.  
   ▪ A detailed description of the market need the opportunity addresses.  
   ▪ An estimate of how many students at Penn are in the target market for this device.  
4. Using the guidelines in Chapter 4, conduct an interview with someone about a lighting product.  
5. Translate some of the subject’s comments into statements of need using the process and rules in Chapter 4.

FEATURED GUESTS  
4:30 – 6:00 in HUNTSMAN HALL G60  
Ronald Wilson  
Co-CEO  
Big Bang Products, LLC  
http://www.bigbangproducts.com/

Do you believe this?  
How would you articulate the “what” that this product addresses (I.e., the underlying need for the product)?
3. Concept Generation and Visual Expression
Tuesday, January 28

REQUIRED
1. U&E Chapter 6
2. “A Critical Review of Popular Creativity-enhancement Methods,” Chapter 3 in Creativity in Product Innovation, by Jacob Goldenberg and David Mazursky, Cambridge University Press, Cambridge, 2002. [This chapter is very short and essentially critiques the most popular techniques for creative thinking. The reading refers to “templates”—a concept we will discuss in class.]

MORE
1. Hanks, Kurt and Larry Belliston, Rapid Viz, Crisp Publications, Menlo Park, CA, 1992. [This book is an excellent guide to basic sketching and drawing, as is most commonly used in design problem solving. A motivated student can learn to draw very well by applying the methods in Rapid Viz.]

PREPARATION QUESTIONS
1. As a creativity exercise, generate 50 names for the opportunity you are pursuing in the course project. Check out the ones you like for dot-com availability at http://www.verisign.com.
2. Introspect on the cognitive processes you are using for name generation. What tricks seem to work for you in stimulating additional names?
3. What’s different (with respect to the naming exercise) about the process of generating concepts for new products?

HAND IN
1. Your team’s mission statement, which is essentially a revision of the opportunity proposal handed in last week reflecting the consensus of your team. Your mission statement should be one page, should adhere to the “what not how” principle and should include the names of the three members of your team.
4. Specifications and Conjoint Analysis  
Tuesday, February 4

REQUIRED
1. U&E Chapter 5

SALSA
1. See Komar and Melamid’s website on paintings based on attribute surveys: http://www.diacenter.org/km

PREPARATION QUESTIONS
1. Pick the five most important customer needs for your project.
2. Write a set of specifications that relate to these needs, following the guidelines in Chapter 5.

HAND IN
1. Your customer needs in the format of Exhibit 4-8. Please do not attempt to do this without reading and following the process in the chapter. Make sure that every statement of need adheres to the rules in Chapter 4. (It would be very surprising if you could not identify more than 30 needs.)
5. Concept Selection and Concept Testing  
Tuesday, February 11

REQUIRED
1. U&E Chapters 7-8

SALSA
1. Vanity Fair article on Segway (WebCafe)

HAND IN
1. Your 10 best concepts. Please describe each concept separately, perhaps on a separate sheet. Annotate your illustration to explain how the concept works. You may illustrate these concepts by hand, using a CAD tool, or any other way you would like. However, eventually these concepts should end up in electronic form submitted on webcafe.

PREPARATION QUESTIONS
1. Identify the criteria most useful for differentiating your concepts.
2. Prepare a screening matrix for your 10 concepts.
3. Form an individual opinion as to which three you feel are most promising.

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Total Score
- A (Reference): 2.75
- DF: 3.45
- E: 3.10
- G+: 3.06

Rank
- A (Reference): 4
- DF: 1
- E: 2
- G+: 3

Continue? No Develop No No
6. Robust Design and Engineering Models
Tuesday, February 18

REQUIRED

HAND IN
1. Your three best concepts. Illustrate these three concepts carefully, in a way that you can test them with consumers.
2. The concept selection matrix you used to narrow your concepts to these three.
3. (Your engineering model, if you did one.)

PREPARATION QUESTIONS
1. Follow the instructions in the document Penn-Catapult.pdf on webcafe. In essence, you are looking for a set of design variables that will result in a launch distance of exactly 96 inches.
2. (Optional… for extra credit) Prepare some kind of engineering model that accurately predicts the launch distance as a function of parameter settings.

PLEASE REMEMBER TO RETURN YOUR CATAPULT KIT TODAY.
7. Cost Models and Target Costing  
Tuesday, February 25

REQUIRED  
1. “Target Costing,” Appendix to Chapter 5, p. 104, U&E.  

SALSA  
1. IKEA Article (on WebCafe)

PREPARATION QUESTIONS  
1. Decide on a target selling price for your product.  
2. What therefore is your manufacturing cost target?

FEATURED “GUEST “ 4:30 – 6:00 in HUNTSMAN HALL G60  
Karl Ulrich  
Karl will present the story of Nova Cruz Products, a company he founded which commercialized a product developed in the context of this class.

HAND IN  
1. Your chosen concept. Please prepare a draft “sell sheet” to illustrate this concept (a one-page flyer describing your concept with its key features/specifications).  
2. A description of the concept testing you performed to make your final concept selection.
8. Prototyping and 3D Sketching
Tuesday, March 4

REQUIRED
1. “Effective Prototyping,” Chapter 12 from U&E.
2. Web lectures on 3D sketching (link to be provided)

HAND IN
1. A preliminary cost analysis of your product and a target selling price (one page only).

PREPARATION QUESTIONS
1. What are the key uncertainties you face with your product?
2. Prepare a prototyping plan to address these uncertainties.

Source: Lunar Design
9. Industrial Design and Human Factors Engineering
Tuesday, March 18

REQUIRED
1. “Industrial Design,” Chapter 10 from U&E.

SALSA

HAND IN
1. Photograph of a proof-of-concept prototype, along with a very short report (<1 page) on what you learned from it.
2. List of target specifications in the form of an updated “sell sheet.”

PREPARATION QUESTIONS
1. What are the key usability issues you face with your product?
2. How will you make your product easy to use?
3. How important is industrial design to the success of your product?

FEATURED GUEST 4:30 – 6:00 in HUNTSMAN HALL G60
Jeffrey Smith, CEO    LUNAR Design    (http://www.lunar.com)
Jeff Smith has led LUNAR Design as President and now CEO since co-founding the firm in 1984. LUNAR specializes in full service product design and engineering and has been ranked by Business Week among the top award winning firms each of the past 12 years the magazine has covered the prestigious IDSA annual IDEA awards.

Over the last 7 years, Mr. Smith has focused mainly upon collaborative development of new business opportunities and corporate design strategies. His efforts in these areas have landed him on the cover of Inc. Magazine's 1999 April issue, where he was highlighted as a leader in using talent networks to build new business opportunities. He has also helped lead major design strategy programs over the last 4 years for Motorola and HP. In these programs, he has integrated the efforts of multiple design firms to bring diversity and breadth to programs with corporate wide influence.
10. Process Selection and Design for Manufacturing
Tuesday, March 25

REQUIRED
2. “Manufacturing for Designers,” Chapter 3 from Dixon. (WebCafe)

PREPARATION QUESTIONS
1. Sketch out the pieces that make up your product.
2. What is each piece made of?
3. How will it be made?
4. Which will be purchased components from catalogs and which will be standard parts?

HAND IN
1. A photograph of an appearance model for your product. What will it look like? This is a "looks like" model, but does not necessarily have to work. (It may, of course, be both a "works like" and a "looks like." This model should include the key aesthetic and user-interface aspects of the product.

BRING TO CLASS A VHS VIDEOCASSETTE (blank or otherwise) THAT YOU ARE WILLING TO DESTROY FOR THE BENEFIT OF YOUR OWN EDUCATION.

Source: Hounshell

Product Design
Spring 2003
11. Naming, Branding, Trademarks and Patents
Tuesday, April 1

REQUIRED

SALSA

MORE (not in bulk pack)

PREPARATION QUESTIONS
1. Draft at least one claim for a potential patent on your course project.

HAND IN
1. An assembly drawing of your product, including views of the outside of the assembled product and an exploded view showing how the pieces go together. Examples of this kind of illustration are provided on webcafe. This documentation may be done with a computer-aided design tool, other graphics software, or may be done carefully by hand.
12. Consulting Sessions
Tuesday, April 8

TODAY is a project consulting day. Sign up for a time slot on WebCafe.

HAND IN
1. Specify the manufacturing process or supplier selection for each component of your product
   - For standard purchased components provide the supplier name and part number.
   - For custom components, provide a sketch or drawing of the part, a description of the material to be used, and a description of the intended production process.
   - NOTE: even little pieces of wire or lengths of shrink fit tubing are components…
13. Lifecycle Analysis  
Tuesday, April 15

REQUIRED  
1. A Declaration of Sustainability (webcafe)  
2. Ecoindicator 99 (webcafe)

MORE (not in bulk pack)  

"One statistic makes clear the demand placed on the earth by our economic system: every day the worldwide economy burns an amount of energy the planet required 10,000 days (27 years) to create."  
- Paul Hawken

HAND IN  
1. Bill of materials and cost analysis in the format provided via webcafe  
2. Lifecycle analysis for your product (completed as individuals….not explicitly part of your project).

PREPARATION QUESTIONS  
1. Perform a lifecycle analysis for your product using the methodology in the Ecoindicator reading. If you wish, you may pick a product that interests you, other than your course project product, for this exercise.

FEATURED GUEST  4:30 – 6:00 in HUNTSMAN HALL G60

Brian Kelly  
Executive Director of Operations  
Merck Research Laboratories

http://www.merck.com/mrl/
14. Design Fair
Tuesday, April 22

“Will the dogs eat the dog food?”
- almost any venture capitalist

HAND IN
1. A one-page sell sheet including at least
   - Suggested retail price
   - Photograph of the final prototype
   - Key specifications
   - Features and benefits
2. A final revision of your bill of materials and cost analysis.

Today from 3-6pm you will display your product at the Product Design Fair.

Location to be announced in class and posted on webcafe.

Logistical details to be announced in class and posted on webcafe.

Your product will be evaluated by your classmates and by a sample of Penn students recruited to express their purchase intent.