Managing the New Product Development Process: Startups and Traditional Businesses

Faculty	**Professional Faculty**	**Teaching Assistant**	**Reader**
Alice M. Agogino	*Michael Borrus*	TBA	TBA
Mechanical Engineering	Haas School of Business		
415 Sutardja Dai Hall	and XSeed Capital		
(CITRIS Building)	mborrus@berkeley.edu		
(510) 642-6450			
agogino@berkeley.edu			

Office Hours		*TBA*	*TBA*
	T, 1-2:30 pm, Haas School of Business,F502 Haas or		
Th 3:00-4:00 pm,	by appointment, generally	Friday afternoons,	
415 Sutardja Dai Hall	before or after class	after workshop	
(CITRIS Building) or		Cal Design Studio	
after class		494 Wurster Hall	

BERKELEY CLASS MEETINGS	**OPTIONAL WORKSHOPS**
Tuesday/Thursdays	Friday afternoon, noon-1:00 pm
11:00 am -12:30 pm	I-Lab, Memorial Stadium
Cal Design Lab	

DESCRIPTION

This course is operationally focused and aims to develop the interdisciplinary skills required for successful product development in today's competitive marketplace -- both in established enterprises and entrepreneurial start-ups. Engineering, iSchool, Business, Industrial Design, etc. students join forces on small product development teams to step through the new product development process in detail, learning about the available tools and techniques to execute each process step along the way. Each student brings his or her own disciplinary perspective to the team effort, and must learn to synthesize that perspective with those of the other students in the group to develop a sound, marketable product. Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice. Although the course focuses on the application of these principles to new product development, they are more broadly applicable to innovation in general – of products, services, organizations, business strategies and governmental policies. This course will also receive credit towards the new Engineers and Business Sustainability Certificate (http://sustainable-engineering.berkeley.edu/).

DESIRED COURSE OUTCOMES

Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice in the context of the "triple bottom line" – economy, environment and society. Students can also expect to appreciate how the application of these tools and techniques, and their variants, differs in an established vs. start-up business.

TOPICS COVERED

Product development processes and organization, product planning, high functioning teamwork, CAD/ solid modeling, customer/user needs assessment, discovery and validation, personas and empathic design, translating the "voice of the customer", concept generation, concept selection, concept

development, decision analysis, concept testing, product architectures, design for variety, design for environment, life cycle assessment, design for assembly/ manufacture, prototyping, design costing, information technologies, design optimization, universal design and entrepreneurship, innovation and intellectual property.

EXPECTATIONS

This is a three-unit graduate course. Accordingly, we have designed the course to demand approximately 9 hours per week of your time. We expect that each student will prepare for and attend all of the class sessions and will participate fully on a project team. This is particularly critical, as most of the class sessions are working sessions during which we expect you to work with your team on your development project. We have tried to smooth the workload for the course so that it will remain relatively constant throughout the semester, and all requirements are clearly spelled out in this syllabus so that you can readily plan ahead.

ACADEMIC INTEGRITY

We encourage full group and class collaboration on all aspects of this course. We expect that all team members will contribute substantially to the project efforts, although some students will choose to devote themselves to the projects beyond what is required for the course. Students will be asked to provide critical feedback and contribute to the projects of others in the class in a cooperative, supportive environment, and will be asked to submit critiques of their own group and group members during the course of the semester.

GRADING

Your course grade will be determined as follows:
- 20% on your attendance and the quality of your preparation for and participation in class discussions
- 20% on the quality of your individual assignments
- 10% for your final design journal (individual)
- 50% on the quality of your team's project-related assignments, final presentation and deliverables. The grade is distributed as follows:
    - o 20% on midterm evaluation
    - o 30% for final deliverables and final presentation to judges at final tradeshow

TEAM PEER ASSESSMENTS

At mid-semester, we will ask for individual peer assessments of the contributions made by your teammates. This assessment will *not* be considered in preparing your final team grade; they are considered an "early warning" for struggling teams. However, we will ask for an end-of-semester peer assessment, which could have an influence on individual grades.

CLASS PREPARATION AND PARTICIPATION

Readings are meant to guide your thinking about the class assignments. Readings are given in the class schedule; we expect you to come to class prepared to discuss the readings and the suggested questions. In any given class session, a handful of students may be called upon specifically to speak about the readings and answer questions about them. If you have prepared in advance according to the syllabus, you will have no problem responding when called upon. Your individual class participation grade will be based upon your in-class remarks during discussions and will be judged by the teaching staff.

LAPTOP, TABLET AND SMARTPHONE POLICY

Haas is encouraging a "no-electronic policy" during lectures and guest speakers. We will follow this policy except for class related use. Class time will focus almost entirely on in-class exercises to bring to life project-based learning. You will need to give your full attention to your teammates, to the work you are being asked to do together, and to what you are taking away from that work. Please do not use your laptops or smart phones in class, unless it is for a class exercise or to take notes (no email, texting, web browsing, Facebook, etc.) Any violation of this policy will lead to a reduction in your participation grade. We love the way Adaptive Path, one of the design firms we work with, describes its policy along these lines:

__Honor the gathering.__ In this ever more interrupt-driven digital world, it's a challenge to bring together all the right people at the same time to think, make and solve problems that are too complex for just a few people to figure out. Gatherings of this magnitude need opening ceremonies to acknowledge the value of the time we are about to spend together. Typically these ceremonies don't include marching bands or fireworks (although that would be cool), but there are small and simple actions that help us all recognize that this is a sacred time. These small things include sending out invitations ahead of time, providing food and drink, creating an environment where people can focus without laptops or smart phones, welcoming and orienting people to our day together, and having the client sponsor begin the workshop with essentially an opening blessing for the people gathered and the work we will accomplish. (www.adaptivepath.com)

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL
Reading Materials: The primary reading material for the class is the textbook *Product Design and Development* (Fifth Edition, but the Fourth edition is OK as well) written by Karl Ulrich and Steve Eppinger. This book is a very basic text that provides a step-by-step view of how new product development processes are to be conducted. Supplemental required course reading materials will also be available on bCourses or linked from our annotated outline of the fourth edition of the textbook at: http://bit.ly/design-TOC. Note the fifth edition has two extra chapters: Chapter 3 *Opportunity Identification* and Chapter 12 *Design for the Environment*. A copy of the fifth edition will be available at both the Haas and Engineering libraries. Most of the additional reading will be available for free on the web or through bCourses. We may use one or two case studies; if so, they will use study.net and non-MBA students need to pay a fee to download.

bCourses: We will make extensive use of the course bCourses web site to both communicate information to you and to converse with you about your homework and your projects. You will find the course listed on http://bcourses.berkeley.edu/. Once you have formed your project groups, we will set up group pages on which we expect you to store your working documents for your project. The faculty will review the group pages regularly to provide feedback on your work.

INDIVIDUAL ASSIGNMENTS
We have periodically assigned individual exercises to have you experiment with some of the concepts we are teaching. Except where noted, all individual assignments are to be submitted to bCourses in the "Assignments" tab under the appropriate heading. All individual assignments are to be submitted **PRIOR TO THE START OF CLASS** on the due date as we will frequently use them for class activities that day. We suggest you also bring a copy of your homework to class to make it easy to share your results for these class activities. Late assignments are discouraged, but will be accepted for one week – penalized 10% for every day late. **CORRECTIONS IN GRADES WILL ONLY BE DONE WITHIN TWO WEEKS OF GRADE POSTINGS, SO PLEASE WATCH YOUR BCOURSES GRADEBOOK.**

PROJECT BACKGROUND AND GENERAL INFORMATION
The goal of the class project is to learn principles and methodologies of product development in a real world context and for those pursuing established enterprises or entrepreneurial startups. Most product

development professionals work under tremendous time pressure and do not have an opportunity to reflect on the development process. In this course, the stress level will be low enough to allow time to experiment and learn. We will form students into project teams of 4 to 5 students, based on their interest in proposed project topics. All teams will have the opportunity to work with students from multiple disciplines, including a mix of Engineering, Business and iSchool students. Some Industrial Design students may be involved as well from UNAM (Autonomous University of Mexico City). You will have opportunities during the first two weeks of class to scope out the possible projects and get to know potential teammates. We especially welcome ideas that could lead to startup businesses. Guidelines for successful projects are as follows:

- There should be a demonstrable market for your product. One good way to verify a market need is to perform a competitive review and identify existing products that try to meet the need. The product does not have to have a tremendous economic potential, but should at least be an attractive opportunity for a small firm.
- If you choose a physical hardware product, it is best to have a product that is not too complex, in regards to the number of parts, say fewer than 10 parts; that said, we are open to more complex product concepts.
- You should be confident of being able to build a reasonable prototype of the product. If you choose to make a hardware product, you must have access to prototyping capabilities. Although a working prototype is always preferred, a combination of a non-functioning "appearance" type model and a rough mechanical or electrical "working" prototype may be acceptable.
    - If a UCB member of your team is interested in using the UCB Mechanical Engineering student shop, you need to go through safety training in the early part of the semester. Gordon Long is the Principal Lab Mechanician in charge of the student machine shop. You will need to visit him or Mick Franssen in 1166 Etcheverry Hall to make an appointment (642-4006). The qualification training is for education and safety purposes. It consists of three 1- hour sessions and a final 2 hour session on an actual hands-on application. He recommends that interested students sign up early during the first 3 weeks of the semester as training is on a first come-first served basis and the schedule gets full later in the semester. Mick Franssen leads a tour of the ME student machine shop in this YouTube video: http://www.youtube.com/watch?v=wNCZJFnXab8&feature=channel.
    - For software user interface products, you should have access to proficiency in Web design tools or other software prototyping tools.
- The product should require no fundamental technological breakthroughs, though it can leverage real technical innovation. We do not have time to deal with large technological uncertainties and you are unlikely to be able to technically derisk a complete breakthrough in the course of the semester. Rather, we are more concerned that you have a specific market need in mind for your project.
- You should have access to more than five potential users of the product (we recommend at least 20). You will need to talk with them or observe them when you launch your product and visit them with your product mock-ups or prototypes.
- Save any highly proprietary ideas for another context, as we will be open in discussing the projects in class and do not wish to be constrained by proprietary information. That said, if you really want to pursue an idea that involves proprietary information, come talk to us -- there may be ways to accommodate you while still accomplishing the course objectives.
- The most successful projects tend to have at least one team member with strong personal interest in the target market. We strongly encourage those of you thinking about starting your own companies to bring your ideas to the class.
- There are lots of poorly designed products out there (see, for example, the badly designed products documented at www.baddesigns.com), but remember, just because there's a poorly designed product doesn't mean there aren't other competitive products out there that are well-designed and can meet the customer requirements. So be sure and do thorough competitive

research. In the age of the Internet, this is pretty simple. Just 15 years ago, trying to find out what else was out there could be a significant undertaking.

Projects adhering to these guidelines will have the greatest probability of success.

TEAM ASSIGNMENTS

Project assignments are intended to pace the development process for your product. All project assignments are clearly spelled out in the class syllabus. Please post the items to be reviewed on bCourses. The team assignments labeled as "deliverables" MUST be turned in at the designated due date. Some of the team assignments are labeled as "check-ins". These are "work in progress" team assignments to allow the teaching staff to give you feedback in class. We ask you to upload your "work in progress" on the due date, but the final could be turned in by the next class time.

All project deliverables (except the project proposal and the sketchbook/journal) are to be completed as a team. Please deliver all assignments according to the following format:
- Submit all project assignments and deliverables electronically. Unlike individual assignments (that are to be submitted through the assignments tab on bCourses on the due date for the assignment), Project Assignments (Check-ins and Deliverables) should be posted to *your group's page* on the project web site where they will be visible to all members of your group as well as all faculty members (and coaches if you choose to include them on your site).
- Maintain a history of your project deliverables on your project Web site so that the faculty can review your progress over time, not just your most recent output. You should save formal project deliverables as well as interim documents on the site.
- Be concise. We like project deliverables that are 2-5 pages in length when possible. The exception to this guideline is concept sketches where one or two concepts per page is preferred.
- Please develop a naming scheme for documents posted to your group website; this scheme should make it obvious to us what the documents are. Name files intended for faculty review should begin with the letters DEL (short for deliverable). Follow DEL with an indication of what the document is. For example, when you submit your mission statement for faculty review, name the link DEL-mission. We will also set up folders in your project web site for each team assignment.

DESIGN COACHES

We are privileged to offer you the opportunity to collaborate with some of the leading experts in product development from prominent firms in the Bay Area. The design coach is tasked with giving you a practitioner's viewpoint and advice on all aspects of your product and product development progress. Given the coaches' many years of experience in product development and coaching design teams for this course, you will find their input invaluable.

We recommend that you contact your design coach immediately after he or she is assigned to your team. We recommend that you designate one team member as the contact person. You should plan on having at least two to three meetings with your coach. We recommend meetings at three of the major milestones: mission statement formation, synthesis of customer and user needs/concept generation, design review or first pass prototype development and assessment. Meetings are typically 60-90 minutes long. You should coordinate the meeting logistics with your coach to suit your team's schedule and your coach's availability. You should prepare an agenda for the meeting ahead of time and share the agenda with your coach. At the meeting, we suggest that you not only brief your coach on your progress to date using your deliverables, design journals, and prototypes, but also come prepared with a specific objective. For example, you might brainstorm concepts or review your prototypes. Bring lots of questions and use the coach''s time wisely. Note that this does not mean

that you have to have everything completed or answered before you go. In fact, the coaches can be most helpful when you are struggling with a choice or direction.

After each meeting, your team should **SUBMIT TO THE GROUP'S BCOURSES FOLDER THE MINUTES OF THE MEETING AND A SUMMARY OF KEY LEARNING FROM THE MEETING**. You may wish to share this with your coach, also.

JOURNAL

Each individual in the class is **REQUIRED** to maintain a design journal throughout the semester, to be turned in at the final project presentation, Saturday, December 12th. It counts 10% towards your individual grade. The journal will be returned at the beginning of Spring Semester. This journal should include your individual thinking (both imagery and words) pertaining to your project. Think of it as a diary of sorts. You may sketch pictures, paste in pictures or business cards, write words, create mindmaps, or choose any other approach that works for you to capture your ideas, thoughts, and reflections about your product and your project. The journal should be used both to *capture ideas* about the product itself as you move through the process, but also to *document thoughts, reflections and insights* on the process of product development, group dynamics, project process, etc. Inventors use journals as it helps to document when they came up with an original idea (useful in the patenting process); engineers do this to work out complex technical details; and designers do this to generate lots of ideas (as ideas feed off of one another); project managers use journals as a management tool to generate "lessons learned" and "best practices" to help run future product development projects more effectively. You can tailor your journal to your own working style and your unique role within your project team. There are copies of exemplary design journals on the bCourses website if you would like to see what one might look like. Only the teaching staff will see these journals; no one else will see them unless you choose to share.

WORKING WITH YOUR TEAM

For some of you, this will be your first experience in working on a collaborative, cross-functional team. Others of you will feel that you are old hands at this. Our experience is that many of you have worked on *group* projects in the past, but not necessarily as a *team*. We hope that through this course you will learn to differentiate the two. There are two reasons, among many, why learning how to work effectively on a team is germane to your success. There is definitive evidence that effective teams outperform groups on ambiguous, complex and interdependent tasks (of which new product development is an example and startups are emblematic). In addition, studies have found that most organizations regularly use cross-functional teams. Thus, it is critical to understand the nature of these types of teams and to learn through participating and leading them. This course is designed to have you take on various roles on the team and at various points to assess patterns of cooperation and team dynamics and reflect on how they impact your team's performance. Over the years of offering this course, we have found that some basic team practices that we teach you greatly benefit both the tangible and intangible outcomes of the team projects. Here are a few recommended best practices for you and your team:

1. ***Commit to regular meeting times.*** Virtual (video-conference, tele-conference and email chats) are good alternatives when face-to-face (optimal) is not possible**.** Structure the meetings with clearly assigned preparation, an agenda, and an end-time. You should have specified desired outcomes from that meeting (next steps, decisions, other actions) for which individuals are responsible. Reserve five minutes at the end of each team meeting to do a wrap up of decisions, assignments and next steps. This will make the meetings and the work in between meetings more productive (i.e., higher quality outputs with less time used over the course of the semester).

2. Please use the team's bCourses e-mail alias to communicate with your team. It will also archive and thread your e-mails so that you can review past conversations. Store shared documents on the group page on the website.
3. ***Work together, not separately.*** Get to know each other's strengths and then leverage them (e.g., who are the CAD or Excel gurus, who's good at organizing and running meetings, who's good at eliciting feedback from customers, etc.?) You will find wide gaps in results between teams that truly collaborate vs. the groups that simply split up the work and staple it together when assignments are due. By design, there are many decisions and outputs you must work through as a team.
4. ***Open and candid communication*** will serve you and your team better than other alternatives. Discuss the means by which you wish to resolve problems as a team (like all teams, you will have problems). Also discuss what strategies you will use if problems persist. Decide, for example, when you want to involve the faculty or your design coaches in helping you resolve problems.
5. Use your team's mission statement to create a ***shared vision*** among the team members that will allow you to stay focused and on target. Make explicit your learning goals up front – both subject matter and experiential. Share them with your teammates so they can support you in those goals throughout the semester. Speak up early if your goals are not being met. Corrective actions early on are typically more valuable to you and your team than end-of-semester adjustments.
6. Have a HiPPO (High-Performance Project Organizer) – a HiPPO is a person that makes sure tasks are on track, deliverables are completed, rooms are reserved, and that everyone knows who's doing what and when the meetings are. They're the person that keeps the team from saying at some point "but I thought Bob was doing that". Note that the HiPPO is not the boss, and it can be a rotating position. And they don't necessarily have to be the "leader" or the "motivator" of the group. It's akin to a project manager position, but not as formal. You may want to split HiPPO responsibilities with different team members for different phases of the new product development process. We'll talk more about this in class. And you might hear us say "Who's your HiPPO for a specific task?"
7. Have fun!