

# Interdisciplinary Design, Entrepreneurship and Service (IDEAS) Course

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## Abstract

The Interdisciplinary Design, Entrepreneurship and Service (IDEAS) course brings together students and faculty from the colleges of Architecture, Business, Engineering, and Liberal Arts to work on socially beneficial projects. The structure of the course, the successes and difficulties, the types of projects, and the feedback from the students and faculty involved and external reviewers will be discussed. The development of this course is sponsored by the NCIIA.

## Introduction

Just as living elements in nature are shaped and defined by their surroundings, so are elements of society. Recent generations have seen their lives defined by a confluence of geo-economic, geopolitical and technological factors. The space/arms race shaped the 1950's and 1960's and the country felt the urgent need to reinforce the technological and industrial base to match up to the Soviet Union. That generation responded with educational changes that manifested in a renewed emphasis on science and engineering fundamentals.

The last decade has brought us the "flat world"<sup>1</sup> and the ready outsourcing of many of the basic skills that were considered vital to the survival of the country just four decades back. Now the threat is not political, military, or technological but economic. It is not that having a firm command of the fundamentals is no longer important; it is that it, by itself, no longer commands the same range of salary and compensation. As a matter of fact, the trend is such that many jobs of the recent past and their associated standards of living might be bifurcating forever.

Conventional pay premiums, the extra pay garnered for work location and other trade considerations, are quickly disappearing in today's global and open economy. The challenge of this generation is to reconfigure the education system so that other forms of pay premiums may emerge, ones that are based on added value. These can take the form of knowledge, hard skills or soft skills. Given the ease with which knowledge is shared and disseminated, a knowledge premium is very hard to maintain and even harder to translate into economic value. Hard skills, such as computer expertise, are knowledge-based and thus follow in that same vein. Soft skills, on the other hand, are entirely different and may be the key to maintaining this country's leadership position.

There is strong consensus about the kind of soft skills that will be needed to see the college-educated workforce through potentially tumultuous times. These are primarily associated with entrepreneurship, innovative thinking, and the ability to work in multidisciplinary groups. Such "situational" skills are quite difficult to instill and are not suited for most of the prevalent higher education models. Yet there have been significant changes in higher education to reflect this newfound need. Some of these changes have been mandated, as is the case with the Accreditation Board of Engineering and Technology (ABET)<sup>2</sup> outcome d requiring that students have an ability to function effectively on multidisciplinary teams. Other changes were encouraged by generous and well-timed funding from agencies and foundations. This course, titled Interdisciplinary Design, Entrepreneurship and Service and referred to by the acronym IDEAS, owes its existence to funding from the Kern Entrepreneurship Education Network (KEEN)<sup>3</sup> and the National Collegiate Inventors and Innovators Alliance (NCIIA)<sup>4</sup>.

Depending on the scale of implementation, interdisciplinary education that emphasizes entrepreneurship traits, creative designs, and innovative solutions could have a transformative effect on industry as well as society in general. There is little doubt about the value of entrepreneurs in creating small businesses, the most reliable economic engine ever conceived. Marry this entrepreneurship drive to science and technology, and high-tech start-ups are created. Engage various disciplines, such as architecture and psychology, into this mix and the stage is set for these small businesses to create world-class products and services. Furthermore, this story is not limited

to small businesses. Large companies in established industries can benefit greatly from having employees with the aforementioned abilities. For example, developing a product or service within the context of a large corporation could be a lot easier than through a start-up, especially concerning marketing and infrastructure. This of course depends on the internal business environment and culture, but that is another topic entirely.

There is also a regional context to this course. At the time of writing this article in the fall of 2007, the state of Michigan had one of the highest unemployment rates and the metropolis of Detroit had one of the highest rates of job loss in the nation. Educating a workforce that is versatile, adaptable, and resourceful, and with an eye for opportunities may be the ticket to reverse this ominous trend. Such an educated workforce would lead to the creation of more small businesses, as well as help the local industry and attract new industries. A single course at one institution is not going to make much difference by itself but could serve as one more successful example that might lead to wholesale curricular changes. The city of Detroit would also benefit if such a creative and enterprising workforce had an eye towards non-profit work and volunteerism. This especially rings true as the city tries to recover from severe demographic and economic hardships. One example is that of energy conservation. There are significant portions of the population with limited means and living in large, old, high-maintenance homes. Heating a house with fifty-year old windows in a cold climate like Detroit's will strain the average budget and lead to excessive and unnecessary greenhouse gas emissions. Helping non-profit organizations that seek to educate and train the population in low-cost techniques of energy conservation was the topic of the first offering of this course in fall 2006. The fall 2007 class is working on a street-level light-rail transit station/stop design that will help ongoing efforts to generate much needed momentum to build a reliable regional mass transit system in Southeast Michigan.

As for an institutional context, the University of Detroit Mercy is a Catholic university in the tradition of the Jesuits and Sisters of Mercy. As such, its mission emphasizes not only a good, well-rounded education but a high level of awareness of social and ethical issues. Service learning and volunteerism are at the bedrock of the Jesuit and Mercy traditions at UDM. Yet, in reference to the biblical analogy of "teaching a person how to fish instead of giving him/her a fish to eat," it is important to instill in the students technology and business abilities to act as a multiplier for their volunteer efforts. To continue with the fishing analogy, UDM students with a social entrepreneurship bent and an awareness of business and technology will seek to create a functional and inexpensive fishing pole, devise an effective way to stock local streams, and create an ecologically safe and economically sustainable scheme to allow the fish stock to stay healthy while feeding the local community. In essence, employ technology and business skills to help people help themselves. This course will help to further the UDM mission primarily by instilling the desire for (and ability to) remedy social inequities. It will seek to improve the lives and livelihoods of the underprivileged through a marriage of creativity, business *savoir faire*, and technology.

There is a wealth of prior experience<sup>5-9</sup> that one can draw upon when creating such a course. There are many courses that bring together students and/or faculty from any number of disciplines such as engineering, marketing, industrial design, and architecture as well as various liberal arts fields of study. This course draws extensively on the state of the art found in the literature and in particular the experiences of the Rensselaer Polytechnic Institute (RPI) in interdisciplinary studio-based design courses and expand that concept by the participation of a broader array of faculty and students<sup>5</sup>.

The remainder of this paper is structured to give a somewhat complete picture of this course. The course objectives and outcomes are presented first as they encapsulate the strategic aim and direction of this course. A course description is presented next along with the course structure, style of instruction, and the project work undertaken. The results of the pilot offering in fall 2006 are presented in the form of assessment of the outcomes and the points of view of the students and instructors. The fall 2007 offering and the prospects for future offerings are discussed from both academic and administrative points of view.

## The Course

Strategically, this course is intended to be the cornerstone of a future certificate/minor program in entrepreneurship. As this minor is intended to be open to all disciplines within UDM, this course had to be structured to accommodate students with all bents and acumens. The course objectives and learning outcomes are mostly intended to be accessible to faculty and students outside of the engineering and business schools. That said, the course is intended

to educate students to be comfortable with technology and business. Thus, at a minimum, students should be able to communicate effectively using the language of technology and business, at least in general terms.

The objective of the IDEAS course is to produce UDM college graduates that are able to identify social/community needs, collaborate effectively across disciplines and expertise, employ technical and design skills to devise solutions, and have the business savvy to turn their endeavors into successful ventures. This course, a cornerstone of a future Technical Entrepreneurship certificate, aims at sowing the seeds of social entrepreneurship in students. These budding social entrepreneurs will aim at the wholesale remedying of social needs/injustices by employing their acquired business and technology skills.

After taking this course, students will be able to:

- a. Conduct interviews and focus groups to determine user needs.
- b. Conduct patent and literature searches to establish the state of the art.
- c. Function in diverse multidisciplinary groups and resolve conflicts in a team context.
- d. Promote and market ideas and designs.
- e. Be sensitive to social and cultural situations that influence design.
- f. Foster creativity through varied individual and team processes.
- g. Appreciate technical, business, technology, and art disciplines.
- h. Integrate interdisciplinary approaches to problem solving.
- i. Conceive and write a business case/plan and a “product pitch.”
- j. Design a system or process to meet desired needs, subject to realistic constraints.
- k. Identify, formulate, and solve engineering, architectural, and digital media problems.

The structure that best suited this course was one that accommodated the diversity of the students and the faculty. The class contact hours were divided up between lectures and studio lab time. A principal instructor oversaw the studio lab time and the project work. The rest of the participating faculty members gave lectures and were present for presentations and office hours. The course structure was further shaped by the requirements of its four main pillars:

- Interdisciplinary: The intent of this course is to foster not just the ability to work across disciplines, but a tendency and a desire for such wide-ranging cooperation. This involves more than just familiarizing a student of one discipline with the *modus operandi* of other disciplines. Students must come to see the value of interdisciplinary cooperation. The surest way to accomplish that is to ensure that every student has a good experience with his/her teammates of other disciplines. On the flip side, there is little that can be done to mitigate the damage done by a student, who through his/her own actions poorly represents his/her discipline. Ensuring the success and harmony of such diverse teams is quite a tall order given that most students are somewhat of an unknown quantity. Managing such widely varying teams will undoubtedly be a heavy task for whoever teaches this course. This problem was mitigated initially by piloting the course using a team of hand-selected students. This will undoubtedly be a challenge once the class has open enrollment.
- Design: There has been a great deal of discussion about the nature and extent of the design work. Engineering and architecture have a tradition of open-ended, semester-long projects while business and liberal arts have more of a tradition of case studies and assigned readings, followed by class discussions. As a result of the involvement of faculty from many disciplines, this class ended up with the best of both worlds: a large and central design project running the length of the semester and a series of lectures and assignments presented at regular intervals.
- Entrepreneurship: Social entrepreneurship is the particular brand that is most relevant for this course. The students would be exposed to entrepreneurship through reading and assignments on the subject as well

as through close contact with successful social entrepreneurs. The latter necessitates to a large extent that the project be sponsored and conducted within the context of a non-profit community service organization. These organizations are highly entrepreneurial as they identify certain needs and seek funding opportunities to fulfill them.

- Service: The service component goes hand-in-hand with social entrepreneurship. At UDM, there are many opportunities for service learning and other service activities. Furthermore, if the project entails creating a product (or service) that would help society, then this aim is fulfilled.

The course was first offered as a pilot in the fall semester of 2006. A decision was made to limit the enrollment to one group of six students working on a single project. The fall 2007 version has open enrollment and is available to students from any discipline. The class has a double listing of ENT 300 and ENT 500. The latter designation is more helpful to seniors and graduate students.

Currently, the course has an enrollment of nine students making up two different teams: four from the college of architecture, two from the department of mechanical engineering, a civil engineering student, a business administration student, and a psychology student. The architecture students are graduate students in the fifth year of a five-year bachelor/master architecture program. The rest of the students are in their junior year. The psychology student is concentrating on industrial/organizational psychology.

The lectures are aimed at emphasizing the skills of teamwork, customer relations, process development, creative thinking, innovative problem solving, and entrepreneurship. These very diverse lectures are made possible and worthwhile in the span of one course and one semester by the fact that each is presented by a faculty member who is a subject matter expert. It also helps that everyone involved had a hand in choosing and scheduling the lecture topics and sequence. The lecture topics in the order in which they were delivered are:

1. Team building and teamwork: This lecture was given by an Industrial/Organizational Psychologist and a faculty member in the department of psychology. The lecture centered on the internal dynamics of teams such as maturation and the emergence of leadership, as well as ways to maximize potential and minimize dysfunction. Context factors that could affect success such as organizational setting and characteristics of team members (for example, skill and attitude homogeneity) were discussed. Potential pitfalls such as self-limiting behaviors and ways to mitigate them concluded this lecture.
2. Basics and techniques of customer interviews and feedback: This lecture was given by a faculty member in the college of architecture. Of all the disciplines involved, architects are perhaps most accustomed to dealing with customers since many are either in private practice or have their own accounts within firms. This lecture dealt with issues of substance, such as ways to formulate questions to gain deep understanding of the needs of the customer. Also, this lecture dealt with questions of style, such as the best setting for the interview and decorum issues.
3. The product development process: This lecture was given by a faculty member of Mechanical Engineering. In this lecture, the students were given an overview of the product design process. A TV news magazine show about product design and the IDEO design center were used to illustrate the generic product design process.
4. Being attuned to socially beneficial work: This talk was given by a faculty member of the Department of Civil and Environmental Engineering who happens to be very involved in community development work. The talk was aimed at showcasing the value of non-profit work to society.
5. Concept generation and selection: This discussion was led by a faculty member of Mechanical Engineering and concerned techniques for ideation, concept generation and concept selection.
6. Perspectives on creativity in art and form: Presented by a faculty member of architecture and digital media, this discussion was meant to show a process that would enable an artist to produce creative and aesthetic shapes and forms as well as music. It is worth noting the intentional use of the word "process" by the faculty member even to describe such a seemingly unstructured activity as art.
7. Perspectives on creativity in the context of inventive problem solving: This lecture was given by a faculty member of Mechanical Engineering and presented the theory of inventive problem solving (known by the Russian

acronym of TRIZ). It is a highly useful process designed to lead to innovative solutions to all types of problems. Product design was emphasized in this lecture.

8. Enabling creative thinking: This lecture was given by a Psychology professor and discussed in detail the personal behavior traits conducive to creativity and the ones that inhibit it. Discussions ranged from internal processes such as self-efficacy and conceptual blocks to external processes such as expanding the definition of a problem and using analogies.
9. Principles of social entrepreneurship: This lecture was given by a Business Administration professor who teaches entrepreneurship and is a small business/start-up expert. The lecture discussed the pillars of entrepreneurship and the great social value to entrepreneurship in general and to social entrepreneurship in particular. The lecture discussed the social entrepreneurship case of micro-credit and the fact that its champions were awarded the Nobel Peace Prize.

The studio lab involved the design and development work for the project. The studio lab time was set at two hours twice a week, thus serving as a significant block of time set aside for the team to interact with each other and with the lab instructor. The time was used by the students for project work and by the lab instructor to reinforce the concepts that were learned in the lectures. The lectures did not have specific assignments, but instead it was agreed that the project work would serve as the assignments. For example, there was no need to have a separate assignment on the product development process, since that's what the students were doing on a large scale anyway. If the studio time is used properly, most of what the students learned in the lectures can be put to practice.

## The Project

The project undertaken in fall 2006 involved the development of training tools and materials to further the cause of energy conservation. It aims to create material (physical hardware as well as web-based software) to help the WARM training center<sup>10</sup>, a non-profit center aimed at promoting sustainable, affordable communities by training low income households in the principles and techniques of energy conservation.

The IDEAS student team responded to the needs of the WARM training center and by extension to the community of Southeast Michigan with what they termed as the Virtual Fully Interactive Training House, or Virtual F.I.T. House. This is embodied in a web-based house design that can be navigated with pop-ups and dialogue boxes. These are meant to inform the user by illustrating changes and techniques that could reduce the household energy consumption and the associated energy bills. Figure 1 shows some snapshots of the interactive website.

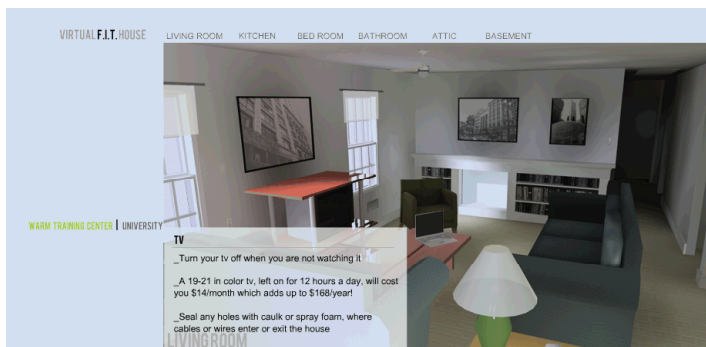




Figure 1. Virtual FIT House main page (top). Living room with pop-up about TV (middle left). Kitchen with pop-up about dishwasher (bottom right).

## Assessment and Viewpoints

The outcomes were assessed using end-of-course surveys and instructor evaluations. Also, the students were asked to write a short essay about their experience. By most measures, this class was a success. The students seemed to enjoy and appreciate the class. The faculty involved fully supported the idea of future multidisciplinary courses including a repeat offering of this one. The administration is investigating ways to mitigate the difficult course load issues stemming from more than one instructor per course. Finally, the customer was very pleased by the superior design and quality of what the students were able to produce.

Basic assessment of the outcomes showed that the students were relatively comfortable with most of the associated skills and abilities. However, they demanded more business involvement in terms of both lectures and project work. More reliable assessment will happen in future offerings of this course with a more general cross-section of students.

Perhaps most telling is the overwhelming endorsement that the students showered on this course at the end of their presentations, stating that “this sort of experience should be required.” They also felt that “the class was a success due to the lectures from the many diverse faculty members.”

When asked to comment on the role of their respective disciplines of study on the outcomes of both the course as well as the project, they were thoughtful and very positive. The architects said that “a fundamental skill of an entrepreneur is to look at a situation and see what can be, not what is to find a solution, architects do this on a daily basis.” The engineers said that “engineering plays an important role in Entrepreneurship due to the ability to look at a problem and find logical solutions.” They continue with: “As engineers, we benefited greatly from working with architects because we were introduced to a more creative/artistic way of thinking. Working with the business and psychology students taught us that there is more to design than just solving the problem. Any solution has to take into account the consumer as well as the bottom line.” The psychologist felt that “the reason why the psychology discipline was an important major to include in this course was because of the knowledge on motivation and how people think.” Overall, the psychology student found “this component of psychology to have the most impact on the final project.”

Obstacles, if any, to continued success of this course are primarily administrative. Despite the overwhelming support of the faculty as well as the administration, the fact remains that this is a single course listing that requires the involvement of upwards of eight faculty members. Faculty course teaching load and the stipulations of the collective bargaining contract are critical issues that must be addressed. One possibility involves a modest stipend system of compensation for the lecture instructors. In any and all cases, this course will be more expensive and harder to maintain than most, if not all other courses. The question is whether it would be worth the added difficulty. The early answer based on the feedback from the students, faculty, and clients, is yes.

## Conclusions

The Interdisciplinary Design, Entrepreneurship and Service (IDEAS) course was piloted successfully in the fall of 2006 with a single team of six students from four different colleges working on an energy conservation project. The design work was done in a studio lab environment with nine lectures on diverse topics that were

given in parallel with the studio. At the writing of this article, the course was being offered during the fall 2007 with two teams working on a design for a transit stop that aims to incorporate public-private financing. The course will be offered on an ongoing basis in the fall term of every year and is expected to be a required course in an eventual entrepreneurship minor program. Administrative hurdles surrounding the involvement of multiple faculty members remain to be addressed.

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