NatSci 190IH
Global Challenges, Scientific Solutions [iCons I]
Spring 2013

Syllabus

Instructors

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Class Meetings, ISB 221

Tuesday 12:00PM – 12:50PM
Thursday 11:15AM – 12:55PM

Course Description

iCons I: "Global Challenges, Scientific Solutions" is a 4-credit course that brings together topics from Life Sciences, Physical Sciences, Natural Systems, and Social Systems in the context of real world scientific issues. Students are expected to grapple with the scientific underpinnings of complex problems, including issues surrounding Clean Water, Climate Change, Energy Demands, and Disease & Biomedicine. Case studies serve as the format and foundation in which students learn and use fundamental scientific principles to investigate these challenges and examine scientific contributions to solutions. Each course activity explicitly marbles content with context; as the case studies reveal a need for students to use a particular concept or skill, those fundamentals are discussed and developed. The specific skills that students master are described in the Student Learning Goals, and the context through which those concepts and skills are motivated is described in the Case Study Outlines. This is the first course in the iCons program, and is a prerequisite for the three subsequent iCons courses. There are no prerequisites for this course, but admission to the iCons program is by application in the semester prior to enrolling in iCons I.

Attendance

Attendance is required for every course period. This is not a course in which you could "get the notes" from someone else. Each day you will be expected to work in and on behalf of your team, and to engage in group- or whole-class discussion and presentation. If you are absent, your team's efforts and product will suffer.

Learning Goals

By participating in iCons, you will work towards several learning goals that permeate the course. Students who demonstrate a high level of skill in these areas by the end of the semester have met the course objectives.

1. Apply distributed expertise in diverse teams to collaboratively solve complex problems and develop leadership qualities.
2. Use scientific principles and concepts, direct observation, and analytical reasoning to understand, explain, and solve real-world problems.
3. Ask scientifically appropriate questions and pose testable hypotheses.
4. Acquire new knowledge through scientific investigation.
5. Identify the components of societal challenges that are appropriate for scientific investigation (and those that are not).
6. Accept and give appropriate feedback and constructive criticism.
7. Articulate the value of individual scientific achievements through their contribution to societal needs.
8. Accurately assess your own abilities, contributions, work, learning processes, and opportunities for growth. Make informed value judgments about them.

Additionally, each case study will have specific scientific content or skills that you will need to master in order to succeed. Examples of these are:

- Communicate scientific information to both scientific and non-scientific audiences.
- Create appropriate experimental design from a scientific question or hypothesis.
- Use computer programming to generate and analyze data sets.
- Formulate a scientific argument supported by primary data.
- Apply mathematical skills to evaluate magnitudes, rates, and cause-and-effect relationships associated with societal challenges.
- Understand how experimental design affects the results of a scientific inquiry.
- Determine the validity and reliability of experimental data, and critically assess scientific statements based on that data.
- Develop and use a model to help understand complex relationships.

Course Expectations

In this course, you should expect opportunities to experience:

Interdisciplinarity
Team taught by faculty from different fields confronting relevant, non-disciplinary specific, challenges.
Integration
Every topic is examined with participation from all students and instructors.
Discovery
You will be engaged in an active learning process, discovering scientific principles as they become required for mastery.
Connections
Complete understanding is achieved only through agile use of ideas from all disciplinary fields.
Collaboration
You will work in teams to solve problems and discover concepts. Teams are formed and re-formed as different challenges are presented and different skills are needed.
Mastery
You will become experts in certain topical areas, so that a team of experts can approach a problem as more than a sum-of-parts.
Content
Scientific depth will be developed around timely, relevant, and weighty societal challenges.
Analysis
You will use primary sources (literature and data) to develop understanding through data interpretation and analytical reasoning.
Human Connections
Topics include not only scientific concepts, but their relevance to and impact on human life and society.

Assignments, readings, and course materials

The iCons I course will not use a textbook. Instead, readings, images and videos drawn from published sources will be used. These materials will be made available to enrolled students through Moodle. You will be responsible for completing all assigned readings and web-viewings before class.

While many assignments (reports, experiment design, critiques) will be begun in class, you are responsible for continuing to work on these assignments with your team outside of class. Many assignments (data analysis, proposal design, model design) will only be completed outside of class time. This will require you to organize the most effective means to work with your team (evening face-to-face meetings, Skype, electronic postings, etc.).

Course Outline and Pedagogical Structure

NatSci 190 will meet Tuesday (12 - 1) and Thursday (11:15 - 1). During this time, we will explore case study topics in multi-period, multi-week segments. Each case study will be based on current events that:

1) Illustrate specific societal challenges
2) Have testable, tractable, scientific components
3) Produce broad impact
4) Are fundamental in nature
5) Evoke strong public support or interest
6) Offer hope of an eventual solution

Each segment of a case study will proceed through four stages.

1. **Inception:** The first stage introduces the topic, the issues, the problems, and the underlying science. Here, we generate questions requiring scientific inquiry. *Inception* may involve any/all of: articles, videos, animations, demonstrations, data sets.
2. **Engagement:** The second stage requires teams to become personally invested in the case study. *Engagement* may involve a discussion, initial report, debate, design, list, vote, etc. In *Engagement*, teams of students think about and begin to learn something about the topic, exploring the boundaries of their knowledge, and determine what further information or understanding is required to fully comprehend the topic(s).
3. **Research:** In this stage, teams of students answer what has not been fully or adequately explored and understood during preceding stages. In *Research* students may design an experiment, critically evaluate data, formulate and address hypotheses, compile information to fill in knowledge gaps. At this point, individuals and teams grow new skills and knowledge based on opportunities and necessity evoked by the challenges at hand.
4. **Create:** This is the stage where students integrate new understanding based on what was learned through their research, and build a scientifically meaningful and useful product. In *Creation* a tangible product of the activity is created, such as a revised report, list, design, proposal, etc. Importantly, the knowledge gained during *Creation* involves communication to the rest of the group or class.
5. **Reflect:** At the end of each segment, we will critically examine the process, obstacles, solutions, and outcomes of your own and your team's work on the case. We will recognize areas of growth, where improvements could be made, and specific skills that you will take from the case and transfer to other areas of your work or study. Your own reflection and self-assessment will be included in your iCons portfolio, and help articulate and guide your progress through this course.

Symposium Project

Student teams will, over the course of the semester, research, develop, and deliver a complete set of materials for a novel case study that may be used in the next offering of iCons I. This work will be done outside of class time, and the new case study materials will be presented at an end-of-semester iCons symposium. Details will be presented after completion of the first case study of the semester.

General Education

iCons I is a 4-credit Interdisciplinary General Education course (GenEd 'I' designation). This means that questions, methods and concepts from numerous disciplines will be used, often with no reference to the field from which they are drawn. Students will be expected to bring expertise from their own disciplines to bear on problems, but also integrate across disciplines by working closely with teammates and seeking information wherever necessary.

Experimental Course

iCons I is listed as NatSci190 because it is an experimental course. In this course, we will learn in ways that remain new to us, and we expect new to you as well. Because of that, we together have a unique opportunity to not only participate in but also continue to guide the development of an exciting new course that is part of an exciting new program. We encourage you to approach iCons I as both a learner and a builder, and focus not only on *what* we are doing, but also *how we are doing it*. In fact, we are counting on you - and all future iCons students - to play an integral role in the establishment and evolution of this program.