

## **Engineering 341: Innovation, Design & Spirituality**

*For the Frugal Innovation graduate sequence*

Thursdays, 5:10-7 pm in the Frugal Lab/Kenna 109

Spring Quarter 2014

Keith Douglass Warner OFM, Director of Education and Action Research

[Center for Science, Technology, and Society](#)

[Kwarner@scu.edu](mailto:Kwarner@scu.edu) and [my personal research webpage](#)

This course investigates the social, human, creative and ethical dimensions of frugal innovation for graduate engineering students. It analyzes these within the broader context of engineering, innovation, design, spirituality and vocational discernment. [Frugal innovation](#) is a creative engineering design process to address the basic human needs of people in poor communities worldwide. This course presents the “what” and the “how” of frugal innovation, but emphasizes the “why” and the “who.” Why should engineers and technology creation address the needs of economically marginalized communities? And, who are the engineers that are able to create frugal innovation strategies? By framing innovation and design in terms of moral purpose and spiritual meaning, students will critically examine their leadership skills and deepen their self-knowledge.

### **The following text books are required:**

Isaacson, W. 2011. [Steve Jobs: The Exclusive Biography](#). Random House. “JOBS”

Lowney, C. 2003. [Heroic Leadership: Best Practices From A 450-year-old Company That Changed The World](#). Loyola Press. “LEADERSHIP”

NOTE: Students are *STRONGLY URGED* to purchase JOBS in advance and read as much of it as possible prior to the beginning of class, especially chapters 1-15 (but note that we will discuss some of these chapters in general terms). Note that this course focuses chiefly on the professional dimensions of his life (with the exception of the first 5 chapters). Your instructor recommends audiobook version, available on iTunes, although a hard copy or e-book will be required for class.

All the individual readings are available from the following Class Cloud Library URL.

You should be able to download the whole folder once. <https://csts.box.com/s/ve3owk3un3j9jufvc75c>

In addition, students will find helpful to view the following videos.

**Imagine: How Creativity Works** <http://vimeo.com/38798735>

**Infinite Vision**, about Dr. Govindappa Venkataswamy and frugal innovation in Aravind eye care <http://www.youtube.com/watch?v=MA5Dzlf7JEE>

Steve Jobs' 2005 **Stanford Commencement Address** (four parts) <http://www.youtube.com/watch?v=UF8uR6Z6KLc>

If interested in social entrepreneurship, I recommend the following optional text: John Elkington and Pamela Hartigan. 2008. [The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World](#).

Harvard Business Press. Find this in the bookstore or in the kindle store.

**Student performance is based on the following:**

Readings and class discussions will investigate the nature of innovation through the lenses of social justice, spirituality, vocation, the creative arts, and engineering. Two assignments are focused outward: they will examine the frugal innovation process through the eyes of those creating novel technology and the intended beneficiaries. Two assignments are focused inward. In one, you will reflect upon your own professional experiences to understand more clearly yourself, your leadership strengths and weaknesses, your passion and your gifts. In the other, you will creatively imagine how you might be able to consciously shape your life’s direction to fulfill some of the social justice goals of frugal innovation.

**Summary table of student assignments:**

<b>Assignment</b>	<b>%age</b>	<b>Due week (Friday)</b>	<b>Single pages</b>
Describe frugal innovation in 3 Tech Award videos	15	4	2
Reflect upon your own innovation processes	15	6	2
Analyze 1 innovation process in 1 Tech Award application on a WordPress page	30	9	4
Reflection upon and expression of your vocation to innovate and design	30	11	5
Class <i>presentations</i> and participation	10		
Total	100		

All assignments are due Friday at midnight to [kwarner@scu.edu](mailto:kwarner@scu.edu) All assignments are paperless. You do not have to print out assignments. This saves you money and hassle. However, please return the favor with two very simple steps.

1. Name the file according to the following guideline:  
Year.Course#.Assignment#.Surname -- for example, 12.20.1.Smith
2. Email this as an attachment to [kwarner@scu.edu](mailto:kwarner@scu.edu) and put this same information in the subject line -- for example, 13.341.1.Jones.

This will allow us to keep track of these files easily. Please use pdf or doc or docx file extensions only. If you send the file in another format I will not read it.

**Assignment 1, week 4. Describe frugal innovation in the Tech Awards.**

The [Tech Museum and Santa Clara University](#) sponsor the [Technology Benefiting Humanity Awards](#) every year. The winning technology awards are captured in short, 3-minute videos for years 2007 through 2011 inclusive.

2011 <http://www.youtube.com/playlist?list=PLD5D3BDA920344160>  
2010 <http://www.youtube.com/playlist?list=PL5EB0F39175926716>  
2009 <http://www.youtube.com/playlist?list=PLF55635BE6894A5A3>  
2008 <http://www.youtube.com/playlist?list=PLDA485F0670B1EA07>  
2007 <http://www.youtube.com/playlist?list=PL062D0CDE9C191B4A>

For each of these years, awards are given in 5 categories (environment, education, equality, health, economic development). Select one of these categories, and view 10 videos in this category (over multiple years). Select 3 examples of these 10 to write about. Then:

1. List the names of the 10 Tech Award videos you reviewed, and identify which 3 Tech Awardees you analyzed.
2. Discuss the role of social need (from Hart, Yunus or Presterro) or a design principle from the first third of the Jobs biography in these 3 examples (1 page single spaced).
3. Determine which, if any, of the 8 core competencies of frugal innovation are present in these 3 cases to determine whether this was a frugal innovation (1 page single spaced).

### **Assignment 2, week 6. Innovation and your vocation**

Select 2 descriptions of an innovation process (includes design, creativity and entrepreneurship), one from JOBS and one from LEADERSHIP that speak to you personally or professionally. Summarize them and how they added value to society (1 page single spaced total) and explain what aspects speak to you, your vocation and sense of spirituality (1 page single spaced total). Use the “3 key questions” framework from Neafsy or the video by Michael Himes, reflect upon an experience of an innovation process where you came to know yourself and your gifts more fully. The 25-minute “3 Key Questions” video by Fr. Michael Himes is about discerning one’s vocation. You can find this in 3 parts at the bottom of this webpage (you probably need to copy and paste this into a new browser window): <http://food4thought.tv/fft-bin/f.wk?fft.cont.display+@CCODE=himes>

### **Assignment 3, week 9. Analyze 1 innovation process in 1 Tech Award application**

Select one of the Tech Awardees (must be one of the years for which we have Tech Award Applications), and using the tech award applications in the Class Cloud Library, describe and analyze the innovation process. Who did what and why? What social justice and sustainability goals did the innovator have in mind in the design process? What cultural, economic, organizational aesthetic, design, and engineering innovations were necessary for the technology innovation? Update the information on the tech application if you can. Identify 1 key characteristic of the innovation process from JOBS and 1 from Lehrer to interpret this innovation. Determine if one of the design principles from JOBS (chapters 12 and 26, in dialogue with chapters 27-32) were present. Determine if the innovation process confirms or contradicts the ideas in Lehrer. Use pictures or diagrams, if you can. Can this innovation scale, per the Blueprint to Scale article? This assignment should be 4 pages single spaced.

## **Assignment 4, week 11. Take home final exam: reflection upon and expression of your vocation to innovate and design**

Drawing from the LEADERSHIP text, describe one of your experiences of leadership (however simple) that prompted you to think about your spirituality, vocation or calling (1 page). Select (reference and do not transcribe) and summarize passages from JOBS, LEADERSHIP, Lehrer and Yunus that speak to the question of spirituality, creativity, and innovation (2 pages). Use your self-knowledge and imagination (see LEADERSHIP) to describe how you, 2 years from now, might be able to engage in a frugal innovation process. Describe what kind of skills, employment, resources, networks, imagination might you need to cultivate for this (2 pages). How might your own goals for innovation, design and spirituality might fit together (1 page)? You will benefit from watching the 25-minute “3 Key Questions” video by Fr. Michael Himes about discerning one’s vocation. You can find this in 3 parts at the bottom of this webpage (you probably need to copy and paste this into a new browser window): <http://food4thought.tv/fft-bin/f.wk?fft.cont.display+@CCODE=himes>

### **Weekly schedule of readings**

1. April 3. Introducing keywords, readings, goals of the course.

JOBS chapters 1-6

WWW. DEMAND - ASME Global Development Review – premier issue. Download app at <https://www.asme.org/network/media/demand> Be prepared to discuss cases.

2. April 10. Radha Basu on Frugal Innovation and Base of Pyramid

Basu, Radha, Preeti Banerjee and Elizabeth Sweeny. 2013. Frugal Innovation: Core Competencies to Address Sustainability. *Journal of Management for Global Sustainability* 1:2, 63-82.

Hart, S.L., and C.M. Christensen. (2002). *The Great Leap: Driving Innovation from the Base of the Pyramid*. MIT Sloan Management Review 44, 1: 51-56.

Martin, Roger L., and Sally Osberg. Social entrepreneurship: The case for definition. *Stanford social innovation review* 5.2 (2007): 28-39.

3. April 17. Social innovation; spirituality as response to the needs of others

Prester, T. 2010. Better By Design: how Empathy Can Lead to More Successful Technologies and Services for the Poor. *Innovations: Technology, Governance, Globalization* 5:1. 79-93.

Lehrer, J. 2012. *Imagine: How Creativity Works*. Pages xi-xx and 25-52.

LEADERSHIP chapters 1, 2, 3

4. April 24. Innovation process and society; spirituality of vocation

JOBS chapters 7, 12, 13, 14, 15

## LEADERSHIP 4

Neafsey, J. (2006). *A Sacred Voice Is Calling: Personal Vocation and Social Conscience*. Orbis Books. Chapter 1.

*Be prepared to discuss:* what are the patterns of similarity and difference in the examples of “innovation for society” in the readings?

Select one of the case studies for next class to present next time, and organize into teams

### 5. May 1. Case study presentations in frugal innovation and design for social justice

*Be prepared to present,* in a team, one of the following business case studies (in the cloud), discussing the application of the Y, the Venn of IDS, and lessons from Hart, Presterro, Lehrer, and Yunus.

Shrimali, G., Dhanaraj, C., & Sud, K. M. (2011). Husk Power Systems. Richard Ivey School of Business.

Rangan, V. K. (2006). ApproTEC Kenya: Technologies to Fight Poverty and Create Wealth. Harvard Business School Case 9-503-007, 1-19.

Macke, S., Misra, R., Sharma, A., & Prahalad, C. K. (2003). Jaipur Foot: Challenging Convention. Michigan Business School, 1-21.

Rangan, V.K. (2009). The Aravind Eye Hospital, Madurai, India: In Service for Sight. Harvard Business School Case.

### 6. May 8. Interiority, self-knowledge and engineering leadership with a mission

LEADERSHIP chapters 5, 6, 7

Neafsey, chapter 2 and 3

*Be prepared to discuss* an experience of self-knowledge or spirituality you have experienced in the workplace.

### 7. May 15. Innovation, creativity and aesthetics in design

JOBS chapters 11, 26, 27

Film: <http://www.objectifiedfilm.com/stream> (also on Netflix, iTunes)

Lehrer, J. 2012. *Imagine: How Creativity Works*. Pages 84-111.

*Be prepared to present in class:* what are the patterns of similarity and difference between what Isaacson says about Jobs’ creativity and design vs. what Lehrer proposes?

### 8. May 22. Working with others: leadership and spirituality

LEADERSHIP chapter 11 and conclusion

Neafsey, chapter 3, and Himes video (see assignment 4)

Gill, Kirrin, Kim Brooks, Janna McDougall, Payal Patel, and Aslihan Kes. (2010)

Bridging the Gender Divide: How Technology Can Advance Women Economically. International Center for Research on Women. Pages 5-16 of pdf, or pages 1-12.

Gershenfeld, Neil. "How to make almost anything: The digital fabrication revolution." *Foreign Affairs*. 91 (2012): 58.

*Be prepared to present in class:*

a. Ignatian practices for discernment

- b. What Jobs taught us about working with teams: pro and con
- c. Gender and technology

9. May 29. Magis: scaling social innovation

JOBS 27, 29, 30, 31

CL: Rangan, V.K., and RD Thulasiraj. (2007). "Making Sight Affordable: The Aravind Eye Care System." *Innovations: Technology, Governance, Globalization* 2, 4: 35-49.

CL: Harvey Koh, Ashish Karamchandani and Robert Katz. 2012. From Blueprint to Scale The Case for Philanthropy in Impact Investing. Pages 2-29

*Be prepared to present in class* how Apple's design principles (described in chapters JOBS 11 & 26) appear in one Apple product described in chapters 27, 29, 30, or 31

*Be prepared to discuss* the technology innovation and scaling potential of your Tech Award Innovation (anticipating assignment 3)

10. June 5. Imagination, vocation and innovation

CL: Nicholas, A. (2010). Depth, Universality, and Learned Ministry: Challenges to Jesuit Higher Education today. Address by the Superior General of the Society of Jesus at "Networking Jesuit Higher Education: Shaping the Future for a Humane, Just, Sustainable Globe," Mexico City – April 23, 2010. 1-7.

To read for the take home final: one of the following first person essays.

Fisher, Martin. "Income is development: Kickstart's pumps help Kenyan farmers transition to a cash economy." *Innovations* 1.1 (2006): 9-30.

Flannery, Matt. "Kiva and the birth of person-to-person microfinance." *Innovations* 2.1-2 (2007): 31-56.

Hughes, Nick, and Susie Lonie. "M-PESA: mobile money for the "unbanked" turning cellphones into 24-hour tellers in Kenya." *Innovations* 2.1-2 (2007): 63-81.

Madiath, Joe. "It Takes a Faucet: Realizing Village Development Through Water and Sanitation Initiatives (Innovations Case Narrative: Gram Vikas)." *Innovations* 4.3 (2009): 65-81.