Professional Engineering Seminar # 2: Engineering Education

Speaker: Dr. Richard Miller, Professor in the Department of Civil and Environmental Engineering
Time: 1:00-2:30 PM
Date: June 23, 2010
Venue: University of Cincinnati, Baldwin Hall, room 641

Prepared by:
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Dr. Richard Miller gave this seminar. Dr. Miller is a Professor in the Department of Civil and Environmental Engineering. Dr. Miller's main research focus is pre-stressed concrete structures, bridges, relationship between material damage and structural performance; fracture mechanics of concrete, nondestructive testing of concrete, early age mechanical properties of concrete and concrete structures; performance of civil engineering materials.

Dr. Miller started his talk by asking how engineers think. After some discussion Dr. Miller discussed a book on *Design Thinking* by Michael Speaks from the University of Kentucky, College of Design. Dr. Miller then asked the class: What do engineers do? Most answers were on the technical and traditional side of engineering. He continued his talk by discussing the professional work responsibilities of architects and engineers. Architects are known for their creative thinking, they are the artists whereas the engineers are the ones who make that creative thinking come to reality. Engineers are creative problem solvers recently called as Design Thinking by Michael Speaks.

Dr. Miller Speaking

Dr. Miller uploaded Michael Speaks talk book and showed a video from the website: http://www.Berlage-institute.nl/videos/watch/2009_04_06_design_thinking. During this video, Michael Speaks refers to how Design Thinking are two words that describe an idea. Design is influenced by economic and political realities and often by military needs. Michael Speaks used a slide to demonstrate the shift in design thinking from Modernity which was pre 1960, to post modernity which was 1960 to 1990, to the present day super-modernity. Modernity was all about essence and goods. Post modernity shifted to uncovering truths and services. Present day super modernity was a transform from chatter into knowledge.

Dr. Miller then gave the example of Steven Johnson and Jeff Hawkins. Hawkins is the inventor of the Palm Pilot. Johnson has a book describing his ideas on intelligence[1]. Intelligence is the brain which stores a certain quantity of patterns. Production of new knowledge is by projections of new patterns. Knowledge is produced, not being sought. Our intelligence predicts patterns, by what has been seen before. From these ideas, Hawkins designed the Palm Pilot even before the technology to actually produced one was available. Dr. Miller paused the movie and discussed with the group. He said that there are programs that teach you theory in which you plug and chug. The theory we have sometimes is approximate and based on assumptions idealizing the reality. Dr. Miller used the analogy of knowing how to build a bridge. If the new design for a bridge fits an existing pattern, one knows how to build it. If it doesn't fit any know patterns then to initiate the design one looks at the pattern it is closest to. We should try to build patterns in students' brain so they can then build their own patterns later.

Dr. Miller then returned to the video in which the book *On Bullshit* by Harry G. Frankfurt, Princeton University Press is discussed. This book describes there are two types of people: Liars and Bull shitters. Liars know the truth and choose not to tell it. Bull shitters cover over their agenda and may or may not know the truth.

An article was read about the engineer in design thinking and the difference between an engineer and architect. In the article by Michael Speaks following points were outlined:

- Architects - build (on paper) the design
- Engineers- makes the design a reality, they are optimizers
- There is no longer a fine line between the two jobs
- An engineer: designs and creates
- An architect - solves a design problem
- An engineer – seeks a solution which is not known in advance – the solution is innovative and unanticipated
- Architects are more subjective in their creation. Engineers are more likely to invent something.

An engineer is intelligent in design and see and understand the concept from other points of view during the design process. Engineers repose the problem from these other points of view. Engineers build innovative designs from working on other problems. The engineers then build patterns to use to creatively design solutions in other situations. This design drives innovation - innovation creates new knowledge into the unknown. These new unknowns are the prototypes that become "what ifs" from the new patterns developed.

Dr. Miller discussed how engineering is like playing sport: it's not good to think so much, but it's best to just do. An example of this in the engineering field would be in the field of environmental problems. One solution for sewer overflow could be the use of rain barrels. A problem could be a person

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[1] *Everything Bad Is Good for You: How Today's Popular Culture Is Actually Making Us Smarter* (2005)

remembering to take the rain barrel inside in the winter. Engineers think of why one has to do this and how to fix that.

There is no longer a fine line between architects and engineers. Architects are creative in the overall design whereas engineers are creative in their solutions of problems that make the architects design a reality. Engineers discuss stuff where solutions would never work, but for some reason it does. Engineers come up with innovative ideas that wouldn't have been thought about if the solutions were already there. They work on reforming and reshaping the problem.

In conclusion, engineers build a catalog of problems to use for future patterns, which becomes the body of design knowledge to be used for the next project. Engineering is not about building a remote control; it is about ability to see the other things that others don't see - the innovation. They see: What can this product do better? Engineers take science fiction and develop it into science fact. Overall engineers are about innovation, always planning solutions on how a product can work better, and constantly creating.