Reshaping Engineering Learning from a Social Design Perspective

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CDIO Syllabus

4, Conceiving, Designing Implementing and Operating Systems in the Enterprise and Environmental Context

4.1 External, Societal and environmental context
4.2 Enterprise and business context
4.3 Conceiving, systems engineering and management
4.4 Designing
4.5 Implementing
4.6 operating

products, processes, projects, system, software and materials

How do we find what to “do”
Frustration with Pedagogical Strategies

Top-down policy from Ministry of Education and other government agencies, through funded projects, examples in Taiwan:

Employment Competitiveness (Higher Ed, 2013)
Bifurcating into Research / practice orientation in curriculum

Citizen Core Competency (Advisory Office, 2011)
Ethics, Democracy, Science, Aesthetics, Media
Encouraging Integrating the Core Competency into Technical Courses

Interdisciplinary / New Issues (Advisory Office, 2007)
Science, Technology and Society (STS),

• Problem-Based-Learning, PBL
• Multi-dimensional curriculum map
• Project-Based-Learning
• Industry collaboration

How do we mobilize the Engineering faculties and students?
Important Questions

Within Engineering

– What are the engineering/engineers like in our country, university, college and department?
– What are the industries that are related to our fields and how are they operating?
– What is the engineering culture?

Putting Engineering Practices in a social context
How are we going to contribute to a better society using our engineering practices?
– pressing issues and visionary actions for our society

live stream created by student protester [http://tw.pikolive.com/event/longson3000](http://tw.pikolive.com/event/longson3000)
the Overwhelming Presence of Engineering in Higher Education / Science Education @ Taiwan

Science Majors

Health and welfare 12%
Agriculture 2%
Engineering, manufacturing and construction 24% (F 14%)

Science 10%
Services 10%
Education 3%
Humanities and arts 14%
Social science, business and law 25%, (F 59%)

More than 80% of venture capital

2011, 1.35 million undergraduates, 0.3 million in engineering
Social design

Within the design world, social design is sometimes defined as a design process that contributes to improving human well-being and livelihood.

The term social design is also increasingly used to describe design of the social world. This definition implicates a perception of a man-made reality, which consequently can only be changed by man, and is changed by man all the time. In this view social design is inescapable, it is there whether people are aware of it or not.

The social reality is created as a result of the sum of all our individual actions.

~Wikipedia
designing a social world in engineering schools for spontaneous development of technical competence and understanding of the real world problems.

Like coding:

Hardware — Physical Environment

Software — Engineering Context

Programmer — Resources (theorems, research methods, studies, people) from all fields, e.g. Education, Sociology, History of Science, Science Philosophy, Anthropology, Science Technology and Society (STS)
Actions

• Carefully Created Workspace — facilitate (to make easy) more discussions and team works, for students and faculty members
Student Studio
Kanazawa Institute of Technology, KIT

Library

Media and Printing room

Yumekobo, 夢考坊
Subscribing Local News papers — encourage and support students to stay connected with their local community and industries
Actions

• Carefully Created Workspace — facilitate (to make easy) more discussions and team works, for students and faculty members

• Community-Based Engineering Projects — accessing the needs from the citizens or communities, and communicating outside our comfortable domains
Intelligent mobility aids for the elderly

discuss ideas and innovation with people from different disciplines, inside and outside of engineering with social awareness

Intelligent robotic mobility aids maybe intimidating and not financial friendly for some people.
Longtail Boats in Thailand

Perspective from scholars:
• Noisy for bird-watching, leisure purposes
• Concerns about fuel consumption
• Low propulsion efficiency

Perspectives from locals:
• Masculinity from the locals’ point of view
• Easy to maneuver in shallow water and swampy area with flourishing water plants
• Embedded in Thai culture of mechanization
Japanese Comic book by 倉科遼

about storied of 3 generation in a family teaming up to provide housing solution for different needs

http://i.imgur.com/W0ggN.jpg
Actions

• Carefully Created Workspace — facilitate more discussions and team works, for students and faculty members

• Community Based Engineering Projects — accessing the needs from the citizens and communication outside our comfortable domains

• Innovative Classes, Extra-Curriculum Activities, and Engineering Ethics and other inter-disciplinary courses that reflects
Shipmodel Contest

- Student-ran domestic/international contest
- Conceptual competition, and goal driven competitions
- Presentations and communication skills with the judges and peers
- Judges from academia, industries and younger generation engineers

100+ teams
800~1000 people involved
Wooden Sailboat Building

Community’s plan in recreate ancient boats joined with modern sailing trainers, supporting the wooden boat building class,

• No experiences from the faculty and students about boat building and carpentry

• Translating, interpreting English manuals through discussions, making sense of the theorems previously learned

• Expanding teams,
  + wooden boats builders,
  + science education
International Affairs

- Foreign students in campus for short term visits and studies
- Local students plan and host visiting programs
- Regular training and work meeting outside of classroom
- Looking for opportunities that motivates students to improve, with pressure and honors — Taiwan International Boat shows
Science, Technology and Society

STS Teaching Projects

In Engineering School

- NCTU 交大
  - STS, Control Technology and Society
- STUT 南台
  - Intro. to STS, Engineering Ethics, Engineering and Society, History of Technology
- NCKU 成大
  - Intro. to STS, Engineering Ethics, Environmental Ethics, Philosophy of Technology, History of Engineering
- NKMU 高海大
  - STS, Engineering Ethics and Society, Technical Society and Taiwan Industry, History of Marine Industry
- Others

Engineering Education Reform through STS

National Kaohsiung Marine University Science, Technology and Society (STS) Center
Any changes or inspirations?

— students’ self-reflection, coded

1. Non-Traditional Teaching
2. Changes Thinking Patterns
3. Diverse points of view

Coded into categories

Increase in reflective thinking
Increase in Knowledge
Oberserving
Helpful to future
Nothing

A schl
B schl
C schl
# Integration of Gen. and Professional Competence

<table>
<thead>
<tr>
<th>Key Topics</th>
<th>B, Eng., Ethics &amp; Society</th>
<th>C, Eng. &amp; Society, special topics</th>
<th>Kanazawa Ins. of Tech.</th>
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<tbody>
<tr>
<td>• Expert System/ Power</td>
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<td>• Science Communication</td>
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<td>• Historical View</td>
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<tr>
<td>• Appropriate Technology</td>
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<tr>
<td>• Risk Evaluation, Management, Communication</td>
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<td>• Appropriate Technology</td>
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<tr>
<td>• Ethical dilemmas</td>
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<td>• Ethic tests and guide</td>
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| Goal | Sensitivity, Diverse perspectives, **holistic thinking and practice** | Cultivate the core competence of Eng. Design STS as a tool for Design Engineer | Forster students who can think, make wise decisions, and act |

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<tr>
<th>Individual</th>
<th>→ STS scholars Inter-disciplinary courses by individual faculty members</th>
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<tr>
<td>Institution</td>
<td>Individuals with open minds were recruited as seeds. Mostly stay as Eng. researchers</td>
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<td>Applied Ethics Center for Engineering and Science (ACES)</td>
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<th>Institution</th>
<th>• STS research Center</th>
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<td>• Two courses in dept.</td>
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<td>• Will promote as college electives</td>
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<td>• Eng. Ethic / Eng. &amp; Society as mandatory courses for all dept. in Eng.</td>
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<td>• Regular Teacher’s enrichment workshops</td>
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<td>Ethics across the curriculum: Intro. To Eng.; Japan Studies; Sci. and Eng. Ethics; Design courses; Micro-Insertion</td>
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学会声明—東日本大震災に際して

東日本大震災に際して

このたびの震災で被害を受けられた皆様にお見舞い申し上げるとともに、亡くなられた方々に哀悼の意を表します。また、福島での原発事故には、深い憂慮を示すものです。

科学技術社会論学会は、今から10年前の2001年に発足しました。現在進行中の複合的な事態は、科学、技術、社会の関係の研究を対象とする本学会に、大きな課題を突きつけるものと考えます。原子力も含め、防災、医療などの面でも、科学技術に関わる組織、集団、制度、コミュニケーションがあり方を見直す必要が浮き彫りになってきています。今回の震災は、携帯電話やインターネットが本格的に普及して以来最大規模の広域災害であることも特徴であり、高度技術社会の功罪も吟味される必要があります。

本学会では、年末の年次大会・総会（2011年12月3・4日に京都大学にて開催）を目標として、今回の震災が社会および私達の学会に提示した課題を整理し、社会的な議論を喚起するための活動を展開して参ります。まず、6月中旬に開催予定の学会シンポジウムで開かれた討論の場を設け、12月の学会創立10周年の記念シンポジウム(計画中)では、これまでの学会の活動を振り返り、科学技術社会論が今回の災害のような課題に直面していかなるべきかの検証を行う予定です。

2011年4月10日 会長 中島秀人
Further Work

• More Engineering Study, collaborated between engineering and social science, humanity scholars
  – Knowledge construction in industry and academia
  – Curriculum study

• Connecting with the outside world
  – Communicating across disciplines (not only in Engineering), and social classes

• Contextualize engineering in a modern society and the changing environment
  – Engineering Ethics, Science Technology and Society and others
Co-Constructing Social Norm in Engineering