Social Science Content In Project-Based Engineering

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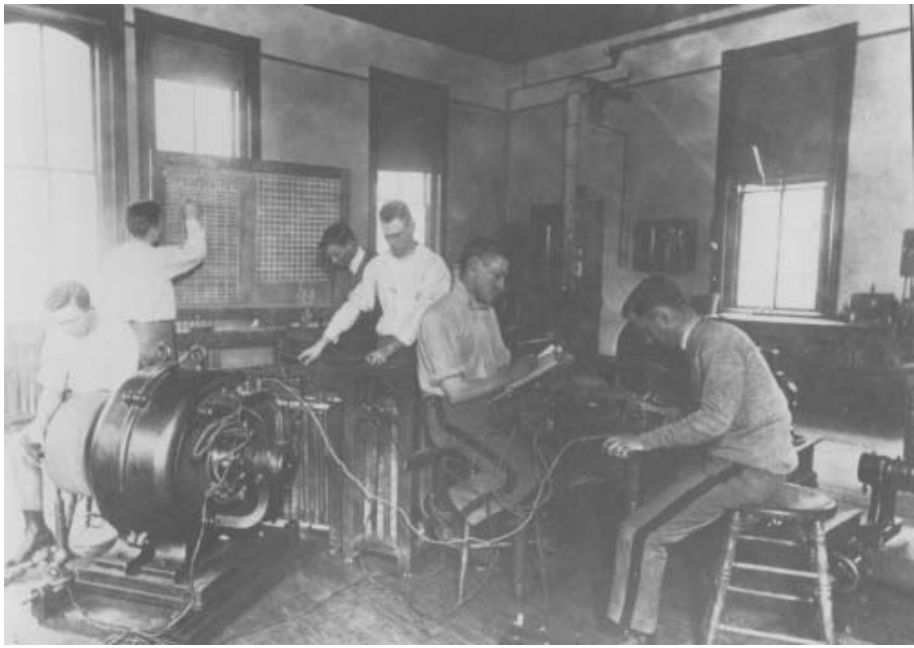
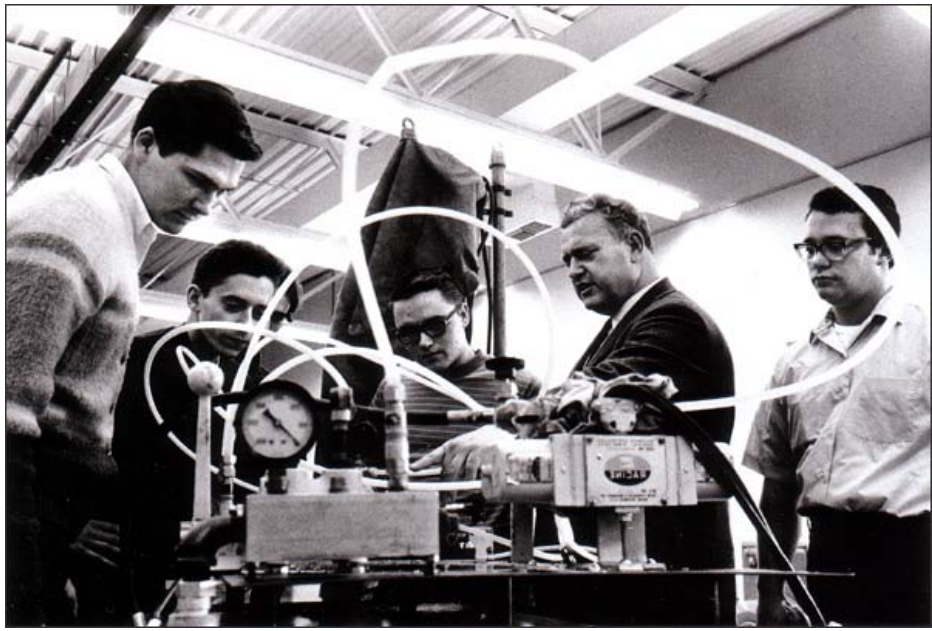
Some historical precedents…



Some historical precedents…

"Project-based" learning has long been part of American engineering curricula



“Non-technical” subjects in optimized engineering education….1880s-1930s:

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-Classical subjects: Greek, Latin, Literature and History

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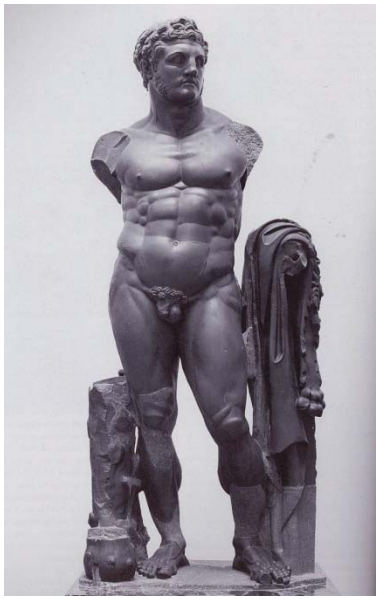

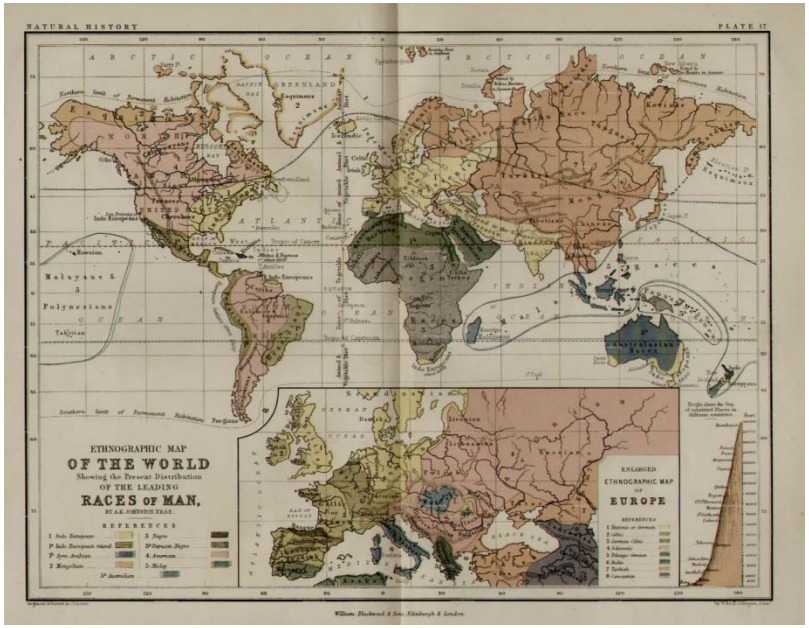

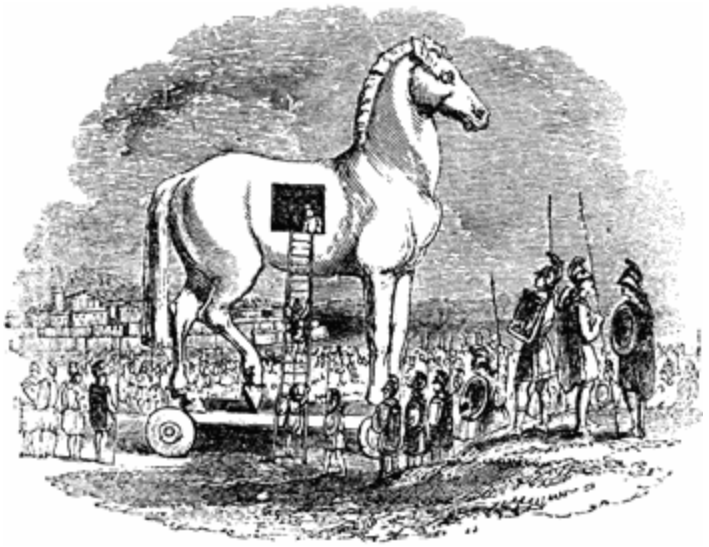

"Hallmarks of Civilization"

Field work is also of vital importance…
“making the man”

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“making the man”

Together, classical instruction and field experience prepare these young men for social leadership (managerial careers)

1940s-1950s

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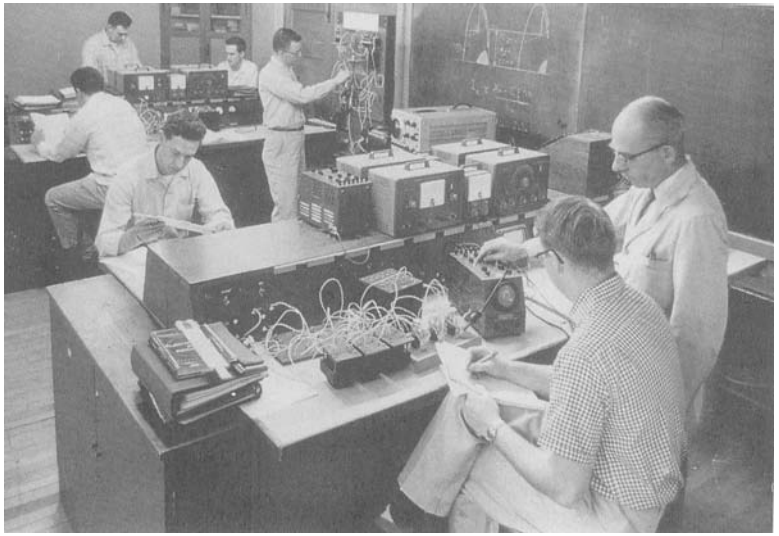
Wartime brings immense growth in engineering education

1940s-1950s

Classics give way to Liberal Arts: Literature and History, Economics …the “Well-rounded” Engineer



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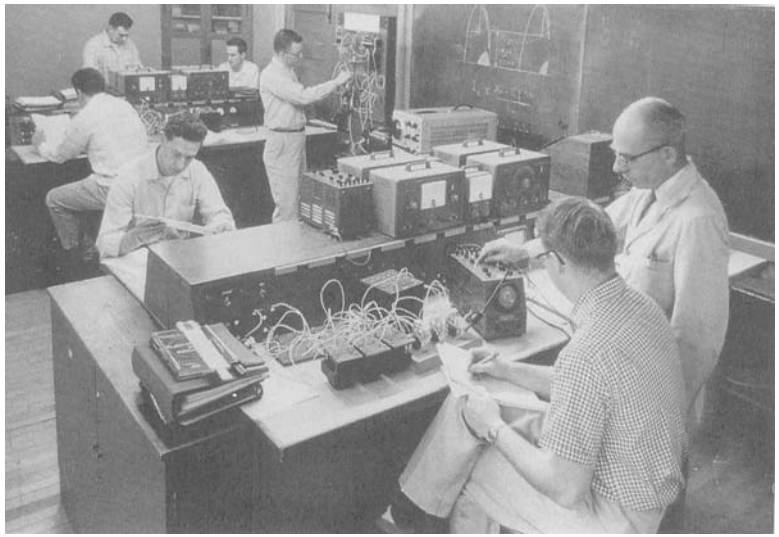
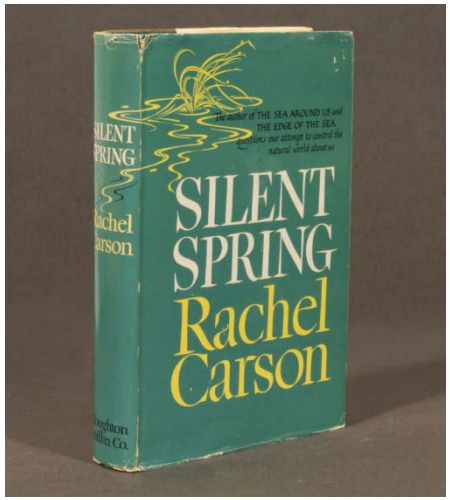


But new stress on science turns attention away from social context and applications

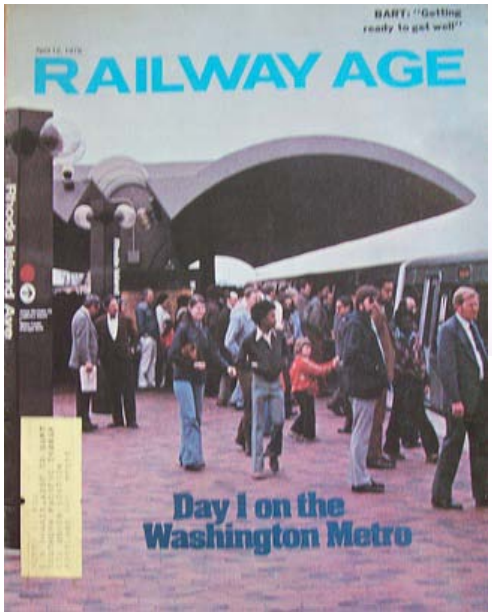
1960s-1970s

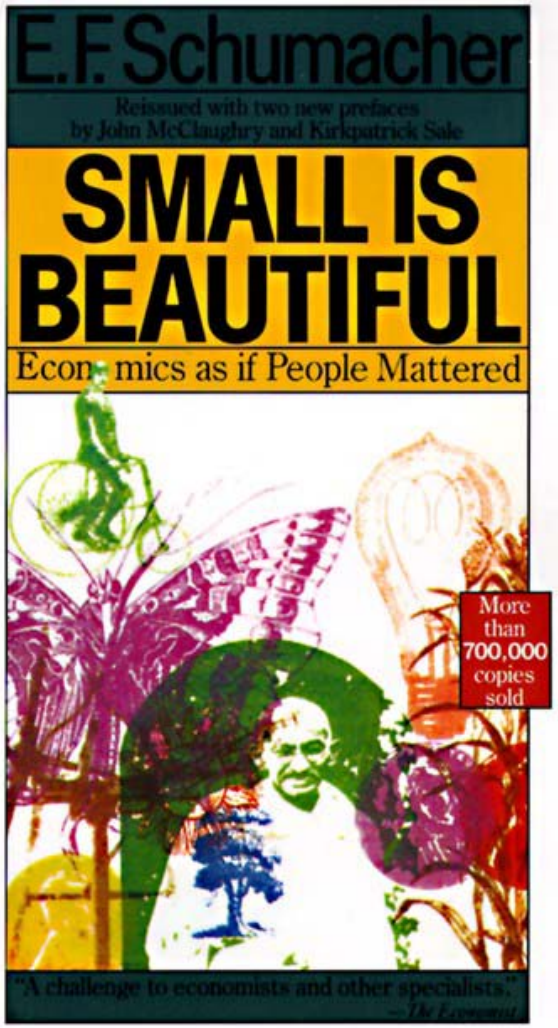
1960s and 1970s



1960s and 1970s

New concerns about social origins and impacts of engineering…new priorities for engineering





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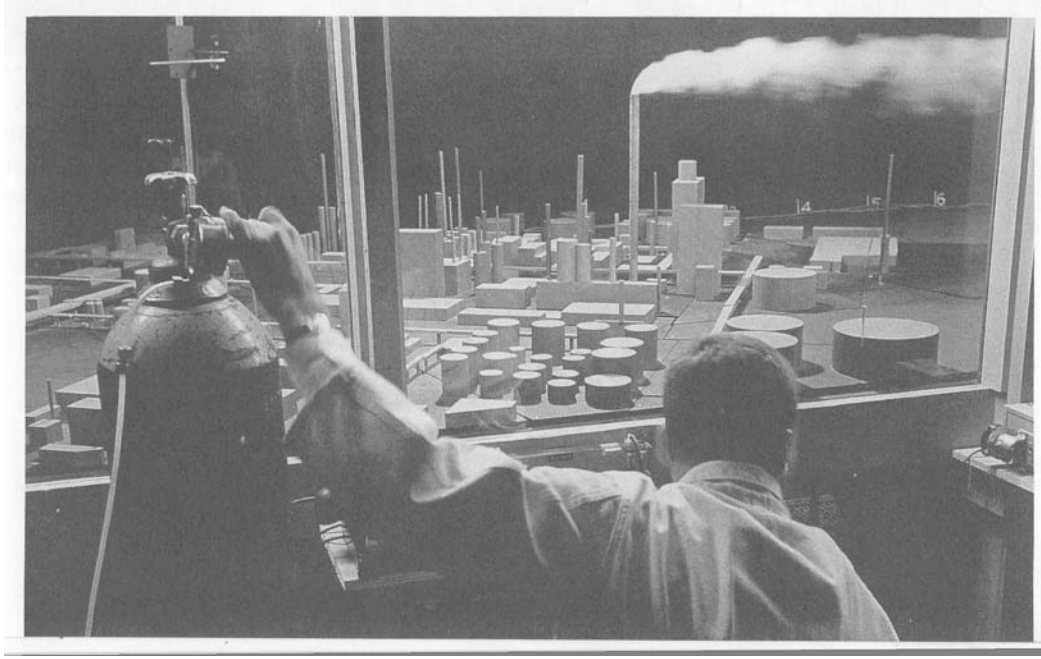

New curricula and degree programs in “Appropriate Technology” and “Science, Technology and Society”

1980s through Today

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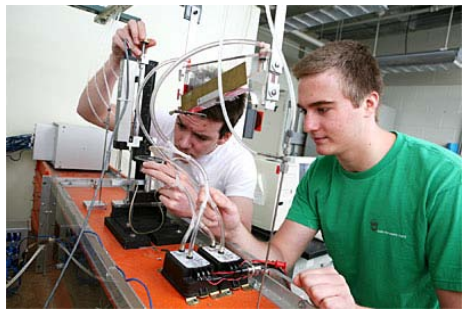
Humanities and Social Sciences…

Requirements return to the notion of separate, compartmentalized courses



1980s through Today

Humanities and Social Sciences…

Requirements return to the notion of separate, compartmentalized courses

For students and faculty: Social origins and impacts of engineering are separate from, and secondary to, the technical

Curricula include science or technology, and liberal arts or social sciences, as distinct “distribution requirements,” and are gauged in terms of outcomes

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-ABET, universities, and employers support this approach

-”Standards” are newly compelling throughout education; metrics for merit

Outcome Number and Title	Level of Achievement 1 Knowledge	2 Comprehension	3 Application	4 Analysis	5 Synthesis	6 Evaluation
Foundational						
1. Mathematics	B	B	B			
2. Natural sciences	B	B	B			
3. Humanities	B	B	B			
4. Social sciences	B	B	B			
Technical						
5. Materials science	B	B	B			
6. Mechanics	B	B	B	B		
7. Experiments	B	B	B	B	M/30	
8. Problem recognition and solving	B	B	B	M/30		
9. Design	B	B	B	B	B	E
10. Sustainability	B	B	B	E		
11. Contemp. issues & hist. perspectives	B	B	B	E		
12. Risk and uncertainty	B	B	B	E		
13. Project management	B	B	B	E		
14. Breadth in civil engineering areas	B	B	B	B		
15. Technical specialization	B	M/30	M/30	M/30	M/30	E
Professional						
16. Communication	B	B	B	B	E	
17. Public policy	B	B	E			
18. Business and public administration	B	B	E			
19. Globalization	B	B	B	E		
20. Leadership	B	B	B	E		
21. Teamwork	B	B	B	E		
22. Attitudes	B	B	E			
23. Lifelong learning	B	B	B	E	E	
24. Professional and ethical responsibility	B	B	B	B	E	E

Key:

B — Portion of the BOK fulfilled through the bachelor's degree

M/30 — Portion of the BOK fulfilled through the master's degree or equivalent (approximately 30 semester credits of acceptable graduate-level or upper-level undergraduate courses in a specialized technical area and/or professional practice area related to civil engineering)

E — Portion of the BOK fulfilled through the prelicensure experience

Figure ES-1. Entry into the practice of civil engineering at the professional level requires fulfilling 24 outcomes to the appropriate levels of achievement.

ASCE "Body of Knowledge For the 21st Century"

“Outcomes”: However unintentionally, values remain distinct from skills related to practice

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Where social scientific or humanities concerns are supplied to engineering students through different classes, departments and instructors and treated as distinct portions of projects, and where instructors treat these concerns as different “moments” or “kinds” of learning… *real integration is unlikely.*

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Structure and Content *Can* Change…

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…a culture change.

Content:

-New core questions:

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-History: City water departments, eng. professionalization patterns, planning priorities that have favored developers, etc.

Content:

-New core questions:

-NOT: “What does the community want from a new storm water system?”

-BUT: “Who needs to be at the table here?”

-Sociology: Bureaucracies can suppress community voices; racial and class tensions can undermine environmental equity, etc.

Content:

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-STS: Deconstruct “cost,” “efficiency,” and “acceptable environmental risks” so that inequities and long-term consequences of particular technical/infrastructural choices become visible

Consider….

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-Low Impact Development (LID)

-Instead of conveying and treating stormwater in large, expensive end-of-pipe facilities, build small-scale, decentralized, lot-level technologies

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-NOT: “What is the best storm water system?”

-BUT: “What can best solve the problem?”

-STS: Deconstruct “cost,” “efficiency,” and “acceptable environmental risks” so that inequities and long-term consequences become visible

-Possibly A NON-ENGINEERING solution would be better…

Content:

-New core questions:

-NOT: “What is the best storm water system?”

-BUT: ~~“What can best solve the problem?”~~

“What *is* the problem?”

“Who decided?”

“What kind of accountability should be established?”

Consider….

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-Different development outlooks

-redevelop underused areas

-Conservation schemes

-educate for sustainability

-Infrastructure or engineering work that is judged by those on whom it has impacts

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-Different development outlooks

-redevelop underused areas

-Conservation schemes

-educate for sustainability

-Infrastructure or engineering work that is judged by all those on whom it has impacts…

…before, during, and after

…with failure as an option

Consider….

Only when engineering learning has the possibility of NON-engineering outcomes will *authentic* socially informed learning take place

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Chi Epsilon's Four Pillars