

浙江大學 ZHEJIANG UNIVERSITY



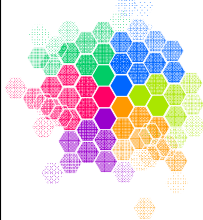

Engineering Education with a Big E: Challenges and Practices

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OUTLINE




- Challenges
- Big E
- Practice



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1 Challenges


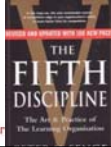

1.1 The Changing Context of Engineering
1.2 Responds from Engineering Education



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1.1 The Changing Context of Engineering

- I. All disciplines and technical fields are continuously infiltrated with each other;
- II. Cutting-edge technologies emerge continuously, while the commercialization cycle has been sharply shortened;
- III. Communications and interactions are deeply enhanced between universities, industries, and the government.
- IV. With the incoming era of Industry 4.0, future engineers are more likely to face challenges of complex systems.


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Challenges for Engineering Education

1. **Curriculums:** Engineering curriculum is lack of integration. We are “print” engineering talents the same way as we cultivate scientists.

2. **Disciplines:** Traditional engineering discipline setting is becoming a barrier for the cooperation among engineering disciplines.


3. **UIG:** Cooperations between universities, industries and government are strongly needed to be strengthened.

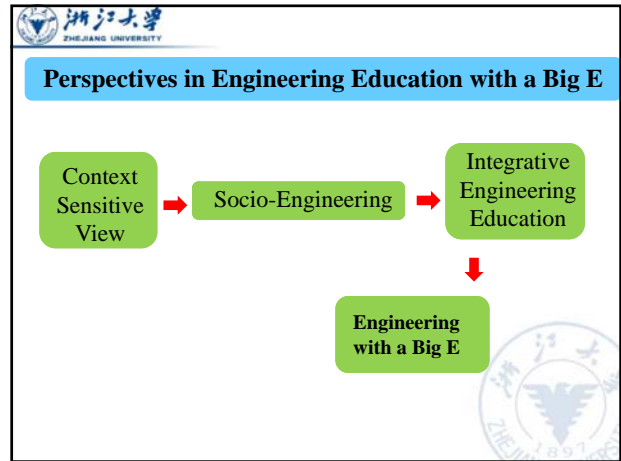
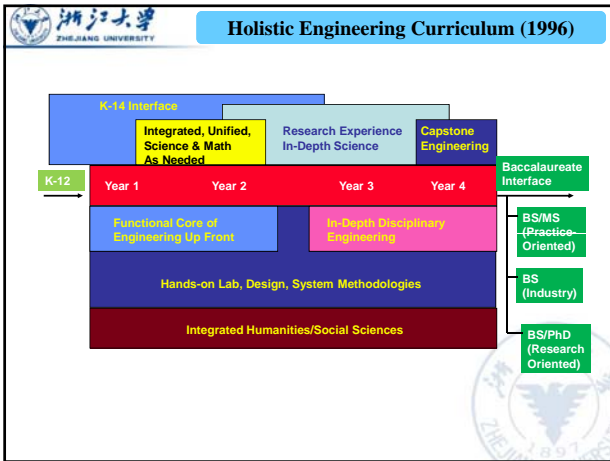
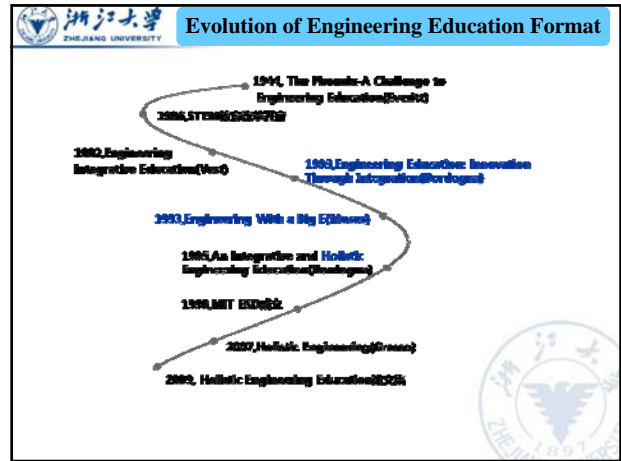
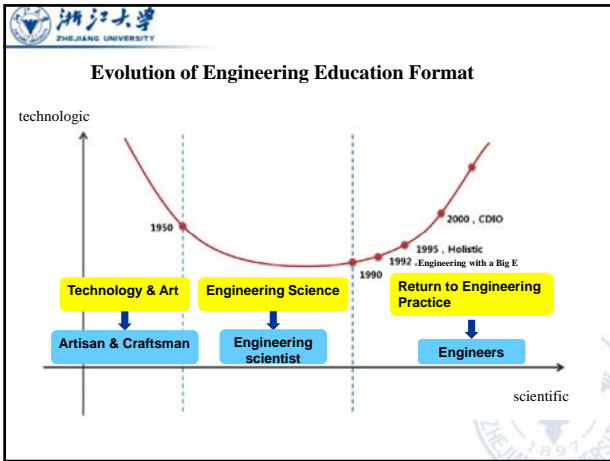


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2 Big E?

2.1 Theoretical Trace
2.2 Summary





Big E is coming up

Context Sensitive View

Context of engineering includes:

- Business and organizational context;
- The needs and desires of customers;
- The social, political, economic, environmental and cultural context of the task;

Big E is coming up

Socio-Engineering

Engineering education in our time had an emphasis on system engineering as well as a requirement of five or even six years' study to offer a first professional engineering degree.

Big E is coming up

Integrative Engineering Education

To enhance the understanding of larger economic, technical, social and political system for technologic innovation.

This idea is based on the concept that “the engineer’s essential role in an organized society is an integrative one”, so the task of the engineer is “the **construction of the whole**”.

Big E is coming up

Interpretive Engineering

In order to improve engineering education, it is not that simple to just add some courses, but to **emphasize on the interactions** between various influences, such as theories of different engineering disciplines, engineering production process and the environment, etc.

Big E is coming up

Engineering with a Big E (MIT)

To educate engineers to concern about a **variety of larger contexts**, i.e., public policy, environment.....

Big E: to Educate engineers with an engineering practice orientation rather than a research orientation which is taken by the Engineering Science Movement.

Big E in MIT

I. First Professional Degree (M.Eng)
Goal: A clear emphasis on preparing students who can perform well in engineering practice.
Practice: 5 years; Certain engineering departments developed a common core of sophomore subjects that all their majors must take.

II. Second Professional Degree (Master programs)
Goal: Meet the industry’s needs of engineers.
Practice: Technology and Policy Program, Management of Technology Program, the Construction Engineering and Management Program, Leaders for Manufacturing Program.

Summary: Engineering with a big E

- To return to **Engineering Practice** which is the soul of engineering;
- To emphasize on a variety of **larger contexts**, i.e., public policy, environment, much bigger than merely engineering technology;
- To **redesign** engineering education curriculum in a comprehensive and integrated method;
- To build a strong **tie** between university and industry;

Practice

③ →

- 3.1 ACEE in ZJU
- 3.2 ACEE Evolution Path Analysis

Advanced Class Engineering Education in Chu Kochen Honor College

On-campus: innovative activities

Off-campus: innovative practice
Thinking innovation + Technologic innovation + business innovation
Engineering research + Innovation and Entrepreneurship Competition

Engineering design
Theory + Methods + Practice
Integrated design + Innovative design + Project design

Fundamentals of natural science, engineering science and mathematics
HASS, Engineering profession ethics, Engineering specifications, engineer certification

Integrated Engineering Education

Innovation of education philosophy

IEE Characters

- To **emphasize** on modeling, design, practice, engineering and technology theories;
- To pioneer a **multidisciplinary** learning environment that integrates engineering theories with practices;
- To redesign engineering **curriculum** based on the idea of Holistic Engineering Curriculum;
- 4 educational **modules**: DTIL program-design, training, internship and leadership;

DTIL Program for ACEE

Design: 工程设计计划

Training: 实践训练计划

Internship: 海外实习计划

Leadership: 领导力开发计划

Design: 工程设计计划

- To **construct a diversified practice platform**
Established a new course *Engineering Design*;
- To **construct diversified innovation teams**
Different disciplines;
Design and develop brand-new engineering device and product;
Understand engineering production process;

Training: 实践训练计划

- To encourage students participating in multiple technology design competitions with designated supervisors from the industry;
- To send students to industry, national research labs to participate in various engineering design and training projects;
- To provide multiple seminars on pre-study, design, development, organization and implementation of large and complex engineering system;

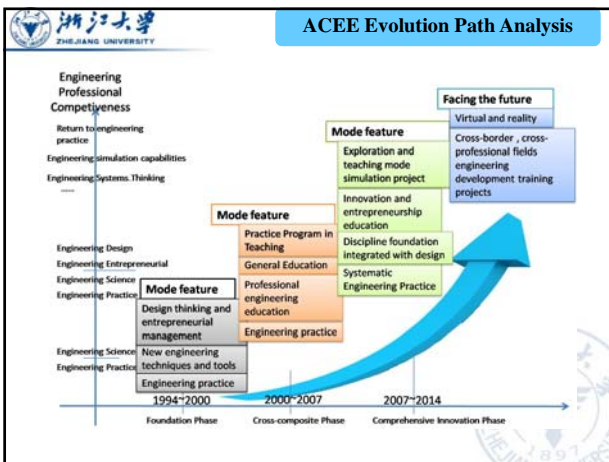
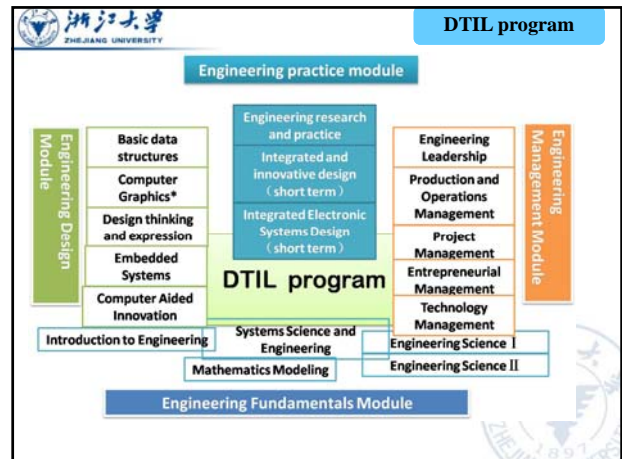
Internship: 海外实习计划

Internship program, sending students to oversea enterprises, like BMW, Siemens, etc..

Leadership: 领导力开发计划

To provide students with management curriculum module to enhance the overall quality of education and to improve students' leadership, ACEE has established courses like:

- Engineering leadership
- Production and operation management
- Project management
- Entrepreneurial management
- Technology management



ACEE Students' Performance

They have:

- Understood more about engineering design;
- Acquired better personal and interpersonal skills;
- Been brave to exchange with a broader and more global vision;
- Got better modeling and simulation skills.

.....

Looking into the Future

- How to figure out the kind of engineering talents the industry needs and integrate our education with it?
- How to cultivate engineering talents more freely and interdisciplinary without the limitation of traditional discipline setting?
- How shall we reform the whole educational system?

