The Singapore University of Technology and Design (SUTD)

- *Nurturing technically-grounded leaders and innovators to serve societal needs through a multi-disciplinary, design-centric education and culture*

Chong Tow Chong, Provost
Singapore University of Technology and Design

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN
Established in collaboration with MIT

Content

- Designing a New University for the 21st Century
- Intellectual footprint & Curricula
- Pedagogy & Culture
- Conclusion

BIG Questions

If you were to create a world class university from scratch for the 21st century, what would you do?

Intellectual Footprint?

Organizational Structure?

Curricula and Degrees?

Teaching Approach?

Research Approach?

Facilities & Campus Design?

Use of Technology?

…?

Going back to history…….

Evolution of engineering education

Industry Revolution

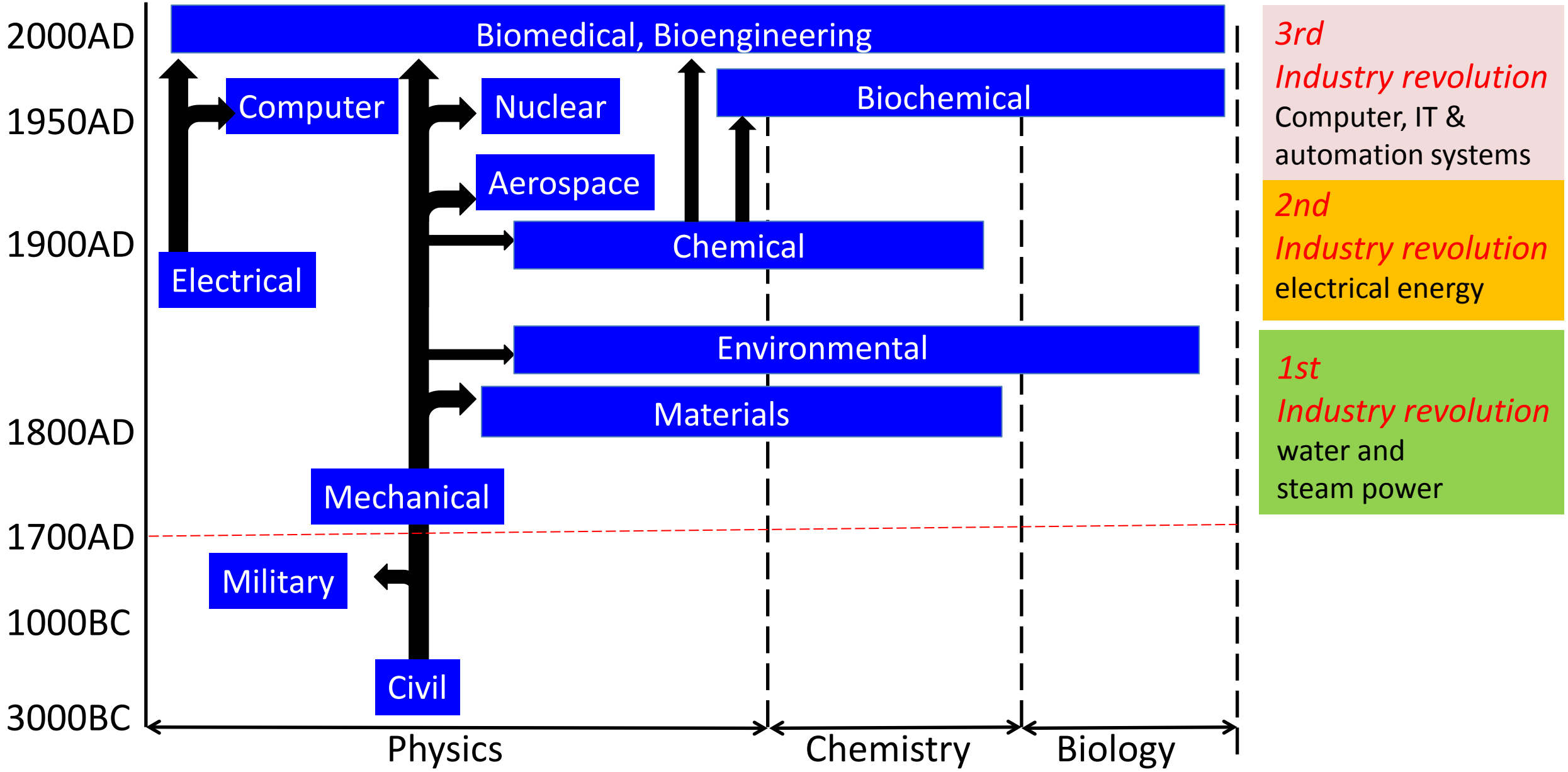
Looking back: Industry Revolution (1760 – 2015)

1st Industry Revolution
1760s-1900
Use of steam and mechanically driven production facilities

2nd Industry Revolution
1900-1970s
Electric Power driven mass production based on division of labor

3rd Industry Revolution
1970s-2015
Digital computing and communication technology for high productivity environment

Source: DFKI



Evolution of Engineering Fducation

Source: 101 Things I Learned in Engineering
John Kuprenas

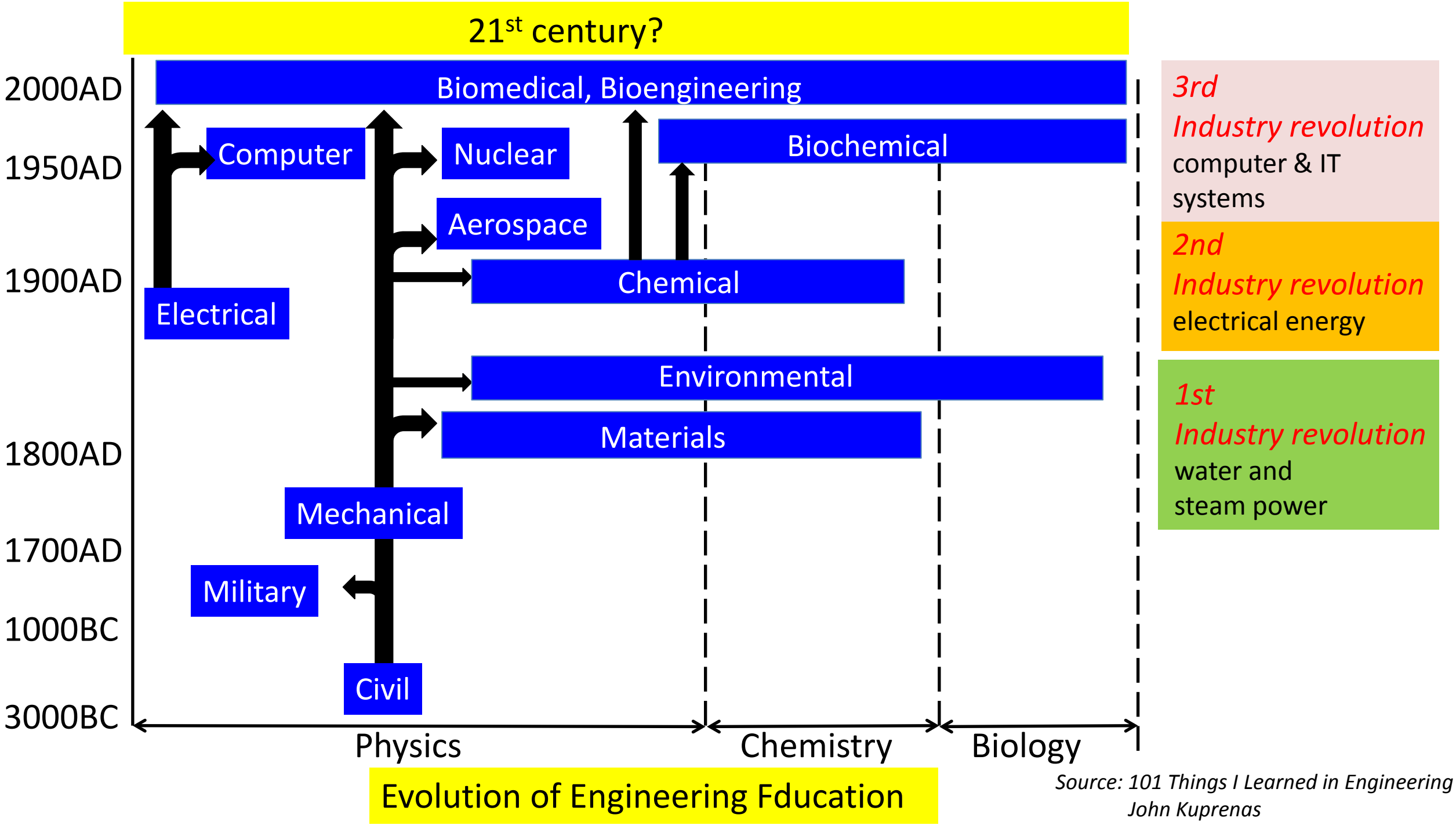
20 Greatest Engineering Achievements of the 20th Century

US National Academy of Engineering (NAE)

20 Greatest Engineering Achievements of the 20th Century

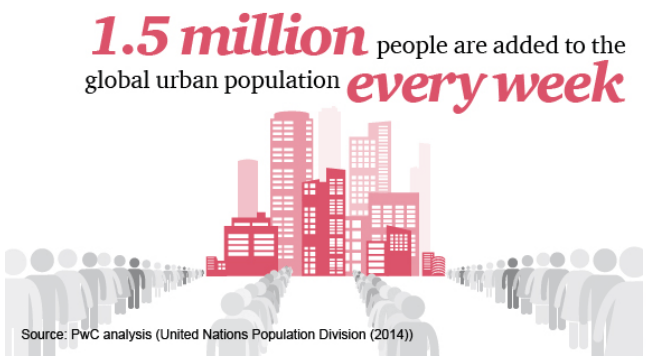
1. Electrification
2. Automobile
3. Airplane
4. Water Supply & Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning & Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum & Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials

US National Academy of Engineering (NAE)



Evolution of Engineering Fducation

Source: 101 Things I Learned in Engineering
John Kuprenas



Rapid Urbanization

Global Warming

The 21st Century

Multi-faceted, global and societally-focused issues

Ageing Society

Security

4th Industry Revolution 2015 – Connected revolution: A ***digital transformation*** where everybody and everything is networked, sharing and processing information as a "huge brain"

To respond to these multi-faceted, global and societally-focused issues, are today universities keeping in pace in educating a new generation of graduates with global mindsets and relevant skills who are capable of providing practical, sustainable solutions that cut across traditional boundaries?

What we have learned over the last year makes clear that American higher education has become what, in the business world, would be called a mature enterprise: increasingly risk-averse, at times self-satisfied, and unduly expensive. It is an enterprise that has yet to address the fundamental issues of how academic programs and institutions must be transformed to serve the changing needs of a knowledge economy. It has yet to successfully confront the impact of globalization, rapidly evolving technologies, an increasingly diverse and aging population, and an evolving marketplace characterized by new needs and new paradigms.

- A report of the Commission Appointed by US Secretary of Education Margaret Spellings (2006)

Learning experience dominated by textbooks, lecturers, and exams.

45% of undergraduates show no statistically significant gains in critical thinking, complex reasoning, or written communications during their first two years of college.

Over four years, more than one-third of students show no real learning gains.

They might graduate, but they are failing to develop the higher-order cognitive skills that is widely assumed college students should master.

- Richard Arum et al Chronicle of Higher Education, 2013

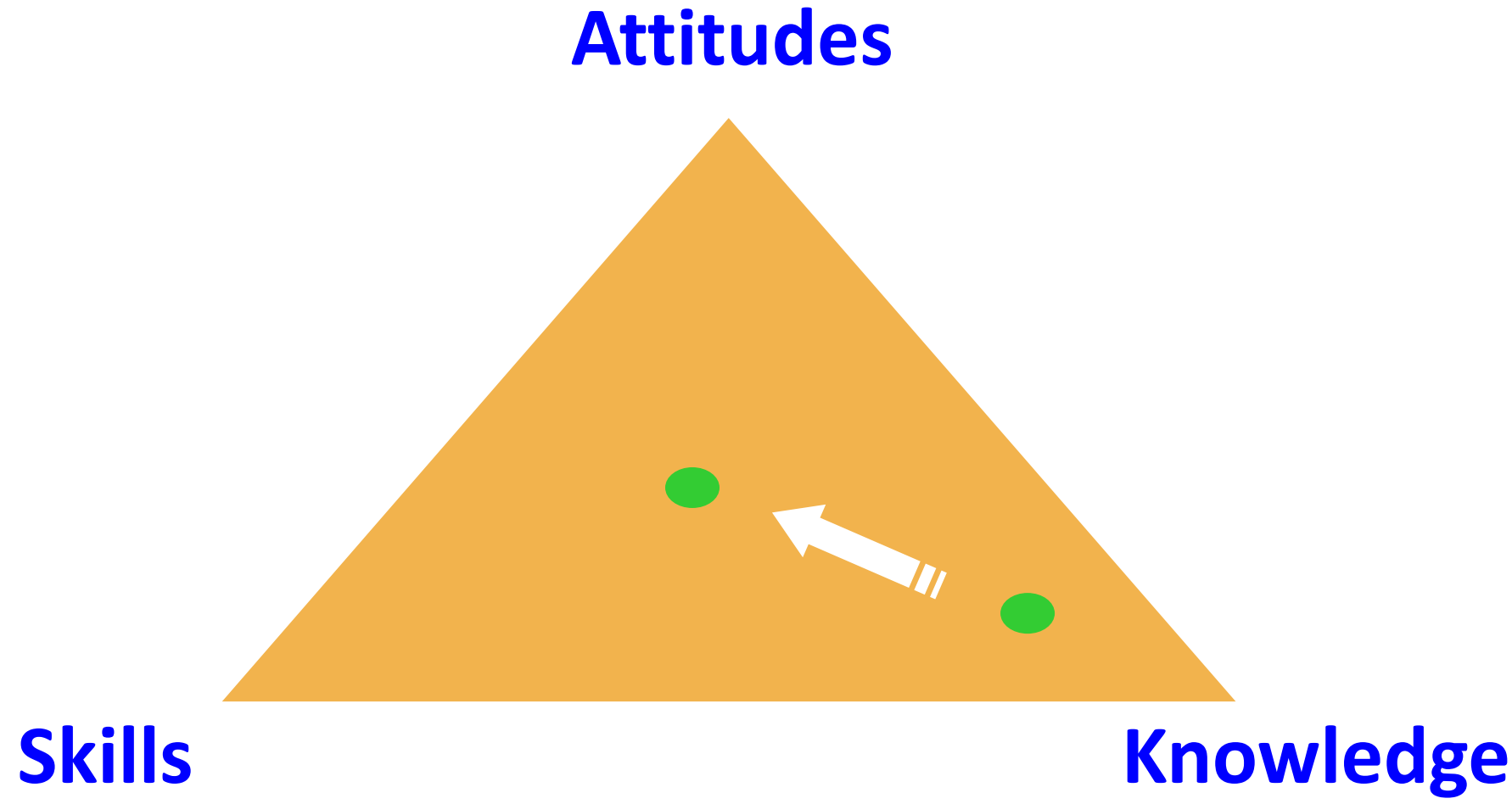
Three areas need to be addressed:

1 **Breaking the siloes created by discipline/department structure**

Breaking down walls to enable interaction and collaboration

Multi-disciplinary learning across boundaries

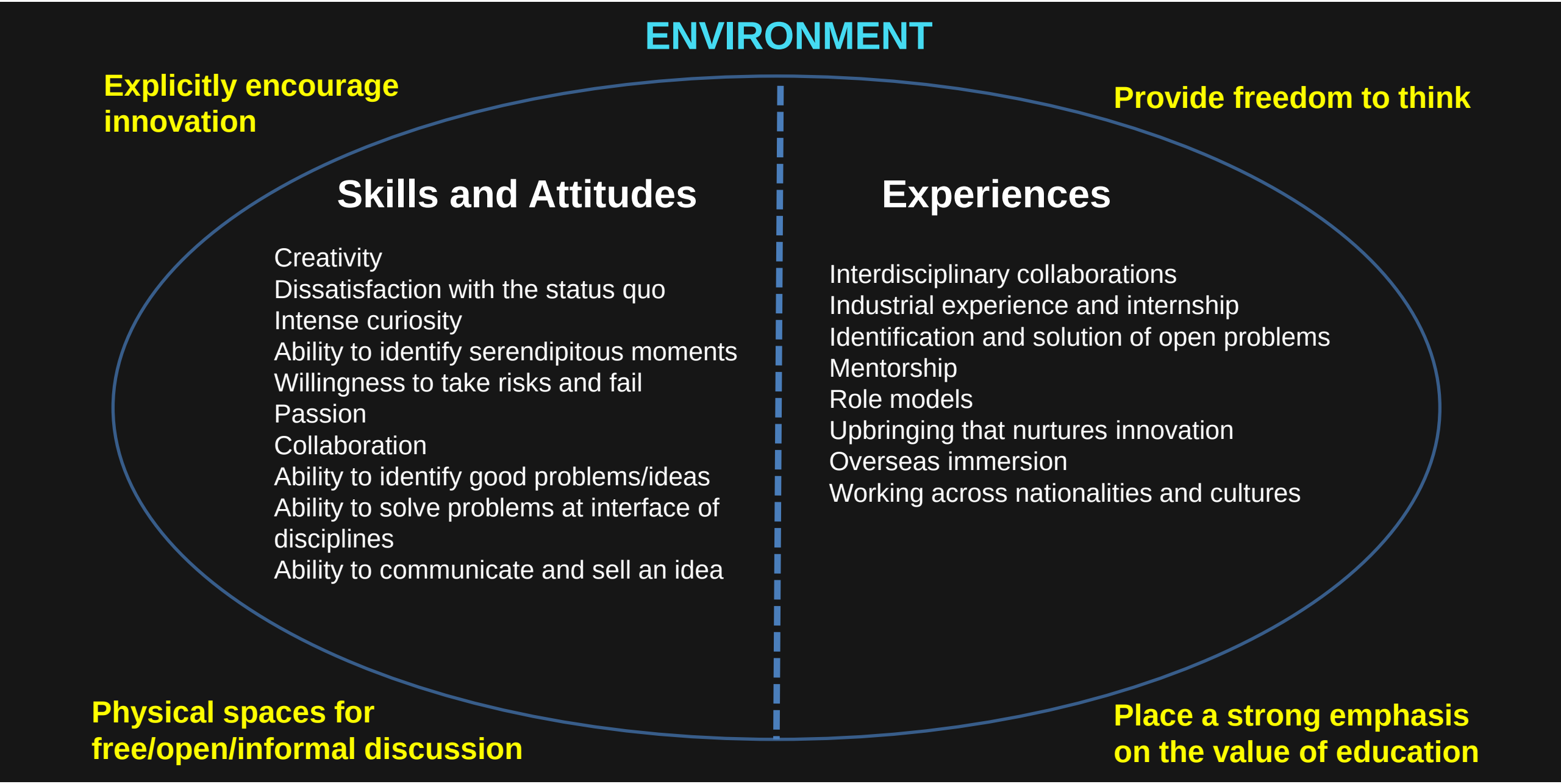
2 Develop skills and attitudes beyond book knowledge



Ability is what you're capable of doing.
Attitude determines how well you do it.

Lou Holtz

From Educate to Innovate



From NAE Press Report: Educate to Innovate

3 Develop curricula, degree structure and pedagogy that can integrate multi-disciplinary learning with relevant skills and global experiences to solve the problems facing society

SUTD's Vision and Mission

To nurture leaders and innovators by imbuing them with multi-disciplinary knowledge and skill sets for addressing the world's challenges of today and tomorrow, and equipping them to be relevant to practice, informed and responsible citizens, and lifelong learners.

SUTD – Our Strategy

Global & Relevant	Strong global partnerships MIT Zhejiang University Outside-In approach centered around Products, Systems & Design
Multi-disciplinary Culture	Focus on Design through integrated multi-disciplinary curriculum and multi-disciplinary research Unique interdisciplinary, no walls, cross boundaries structure Emphasis on Technology, Innovation, Entrepreneurship
Distinctiveness	Beyond teaching knowledge to teaching ways of thinking, how to analyze problems, how to come up with new solutions and possibilities (Skills & Attitudes) Develop graduates with ideas and solutions that have real-world impact and use
Unique Student Experience	Pedagogy, cohort-based, active, interactive and collaborative learning Time and space for passion and self development Diverse and inclusive student body (e.g. diverse backgrounds, high female ratios, etc) Engaging the world through research, internships and entrepreneurship

HOW?

Intellectual Footprint & Curricula

20th Century

Domain & Discipline -driven

Specific disciplines

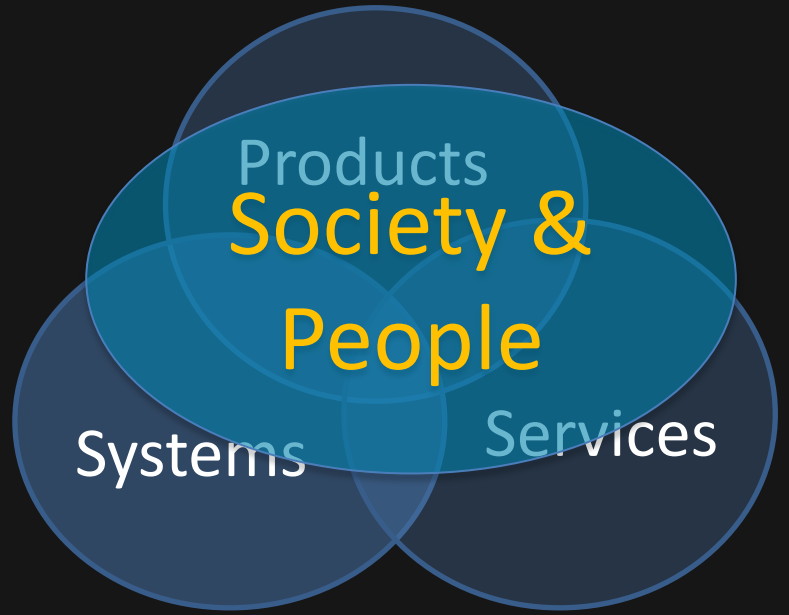
- Civil engineering
- Mechanical engineering
- Electrical engineering
- etc…

Specific industrial segments

- Aeronautical engineering
- Chemical engineering
- Nuclear engineering
- Computer engineering
- etc…

21th Century

A cross-disciplinary, design-centric curriculum integrating knowledge, skills and attitude to serve societal needs



20th Century

Domain & Discipline -driven

Specific disciplines

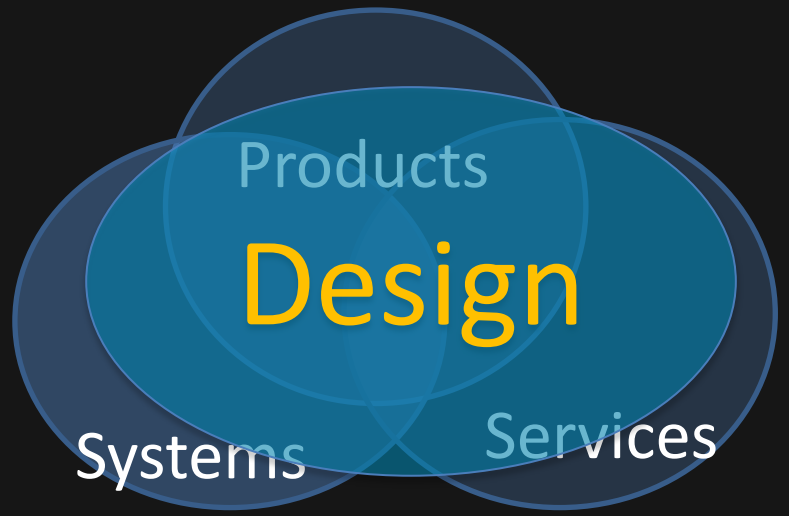
- Civil engineering
- Mechanical engineering
- Electrical engineering
- etc…

Specific industrial segments

- Aeronautical engineering
- Chemical engineering
- Nuclear engineering
- Computer engineering
- etc…

21th Century

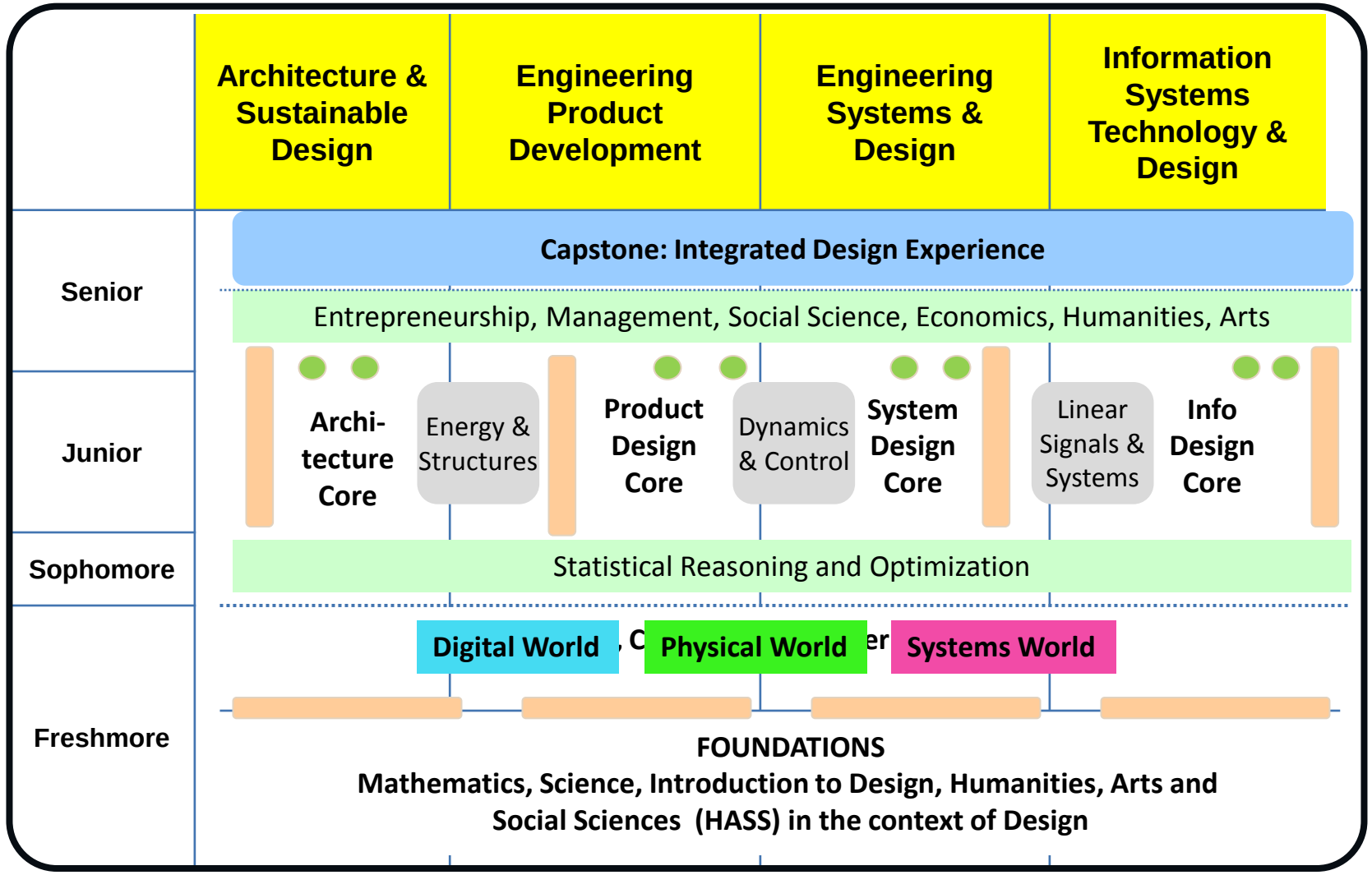
A cross-disciplinary, design-centric curriculum integrating knowledge, skills and attitude to serve societal needs



4 Pillars (what the world needs) …

An Outside-In Approach

An Outside-In Design-Centric Curriculum



Design projects Electives • *22% HASS courses*

- Emphasis of humanities, arts & social sciences
- BIG-D: Design everywhere
- Capstone: Multi-disciplinary design experience

Emphasis on humanities, arts and social sciences (HASS)

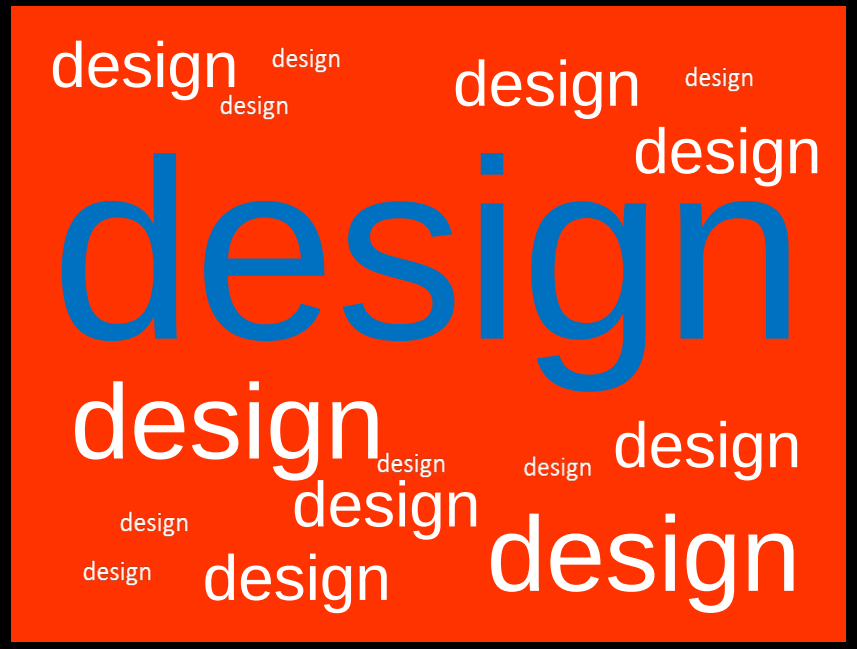
World Texts and Interpretation

Theorizing Society, the Self, and Culture

(Steve Jobs, 2011)

- All students are required to take 7 classes in HASS

By incorporating HASS in the knowledge acquisition of technology and design, SUTD encourages students to acquire self-reflexivity, critical thinking, and communication skills so as to nurture leaders who can lead humane science and build a better society.



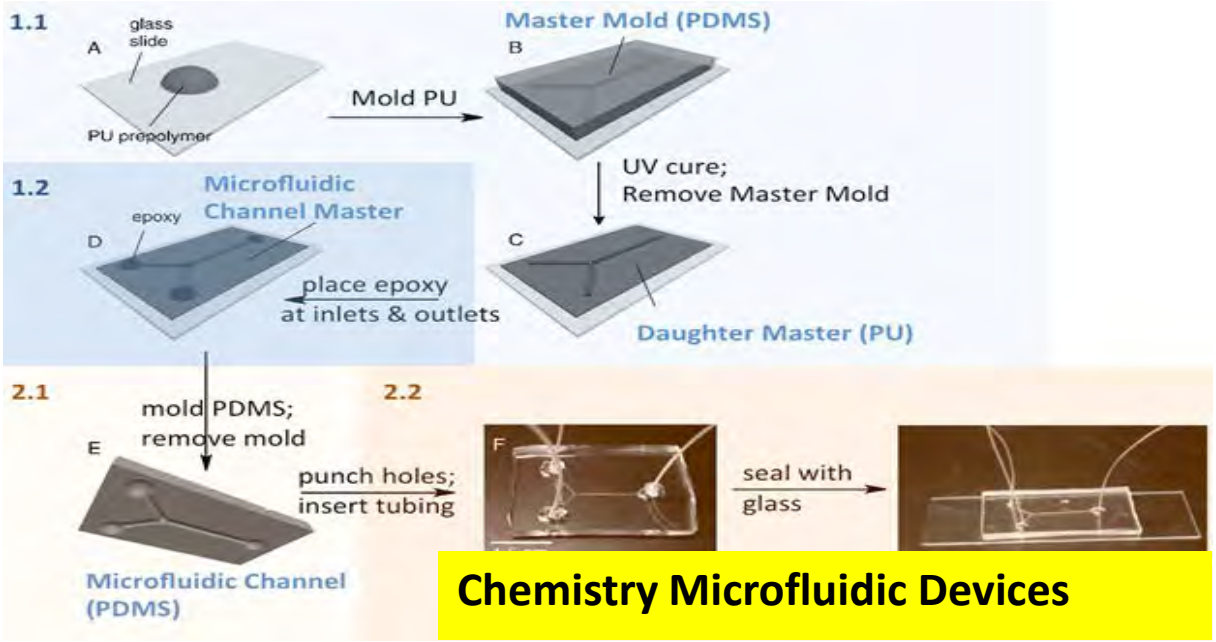
BIG Design

Every one Subject (1D)

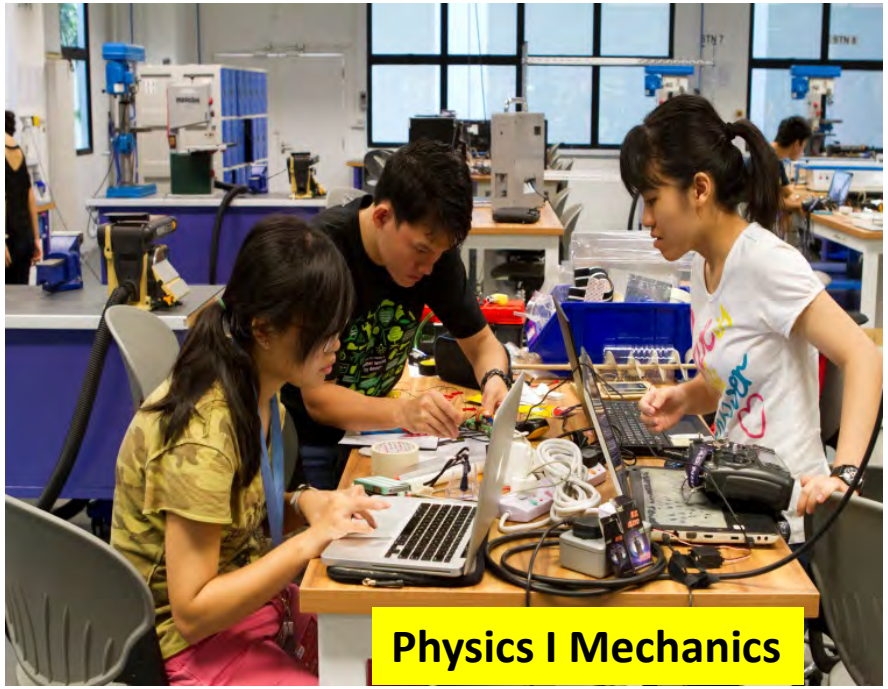
Across Subjects (2D)
pillars
Years (3D)

Design through conception, development, prototyping, manufacturing, operation – the full value chain

1D: Through hands-on and active learning activities.



Chemistry Microfluidic Devices



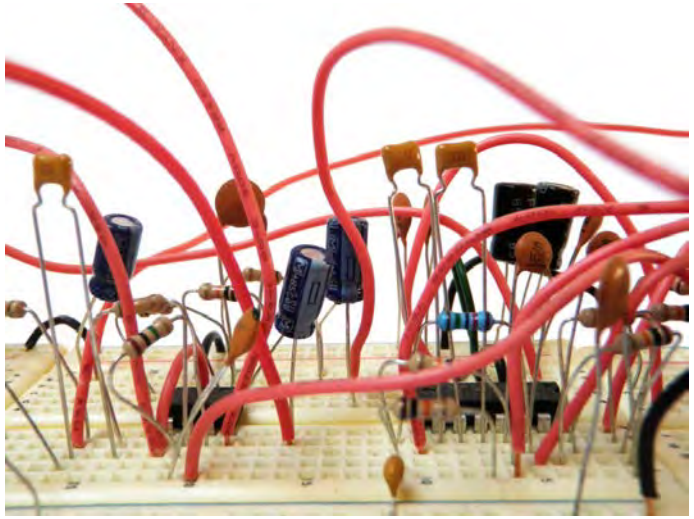
Physics I Mechanics

Heart Hands-on

2D: Making connections between subjects

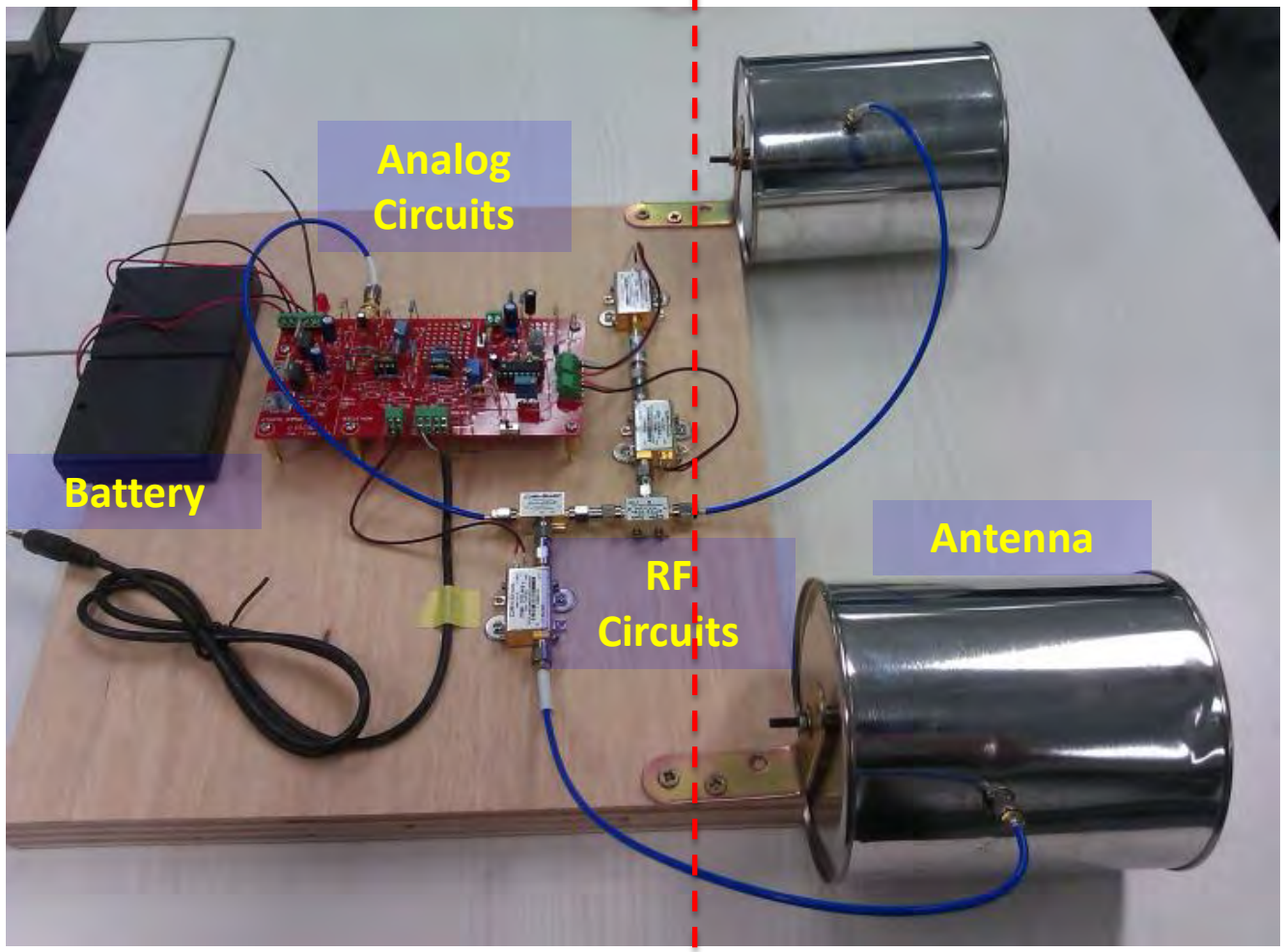
30.001 Structures and Materials

Energy harvesting



30.002 Circuits and Electronics

3D: Subjects across 2 Terms



Circuits & Electronics, Term-4

EM & Applications, Term-5

Capstone Project

A capstone project is an industry/society-focused, multi-disciplinary project for senior-year students to apply the design principles, concepts and techniques they have learned to solve real-world problems as part of a multi-disciplinary team.








Nature of Capstone Project

To include an extensive range of technological design skills and architecture/engineering knowledge such as:

- Identification of needs
- Transforming needs into technical specifications or design strategies
- Applying modelling techniques and evaluating design alternatives
- Using teamwork to resolve the challenges in designing and producing tangible outcomes

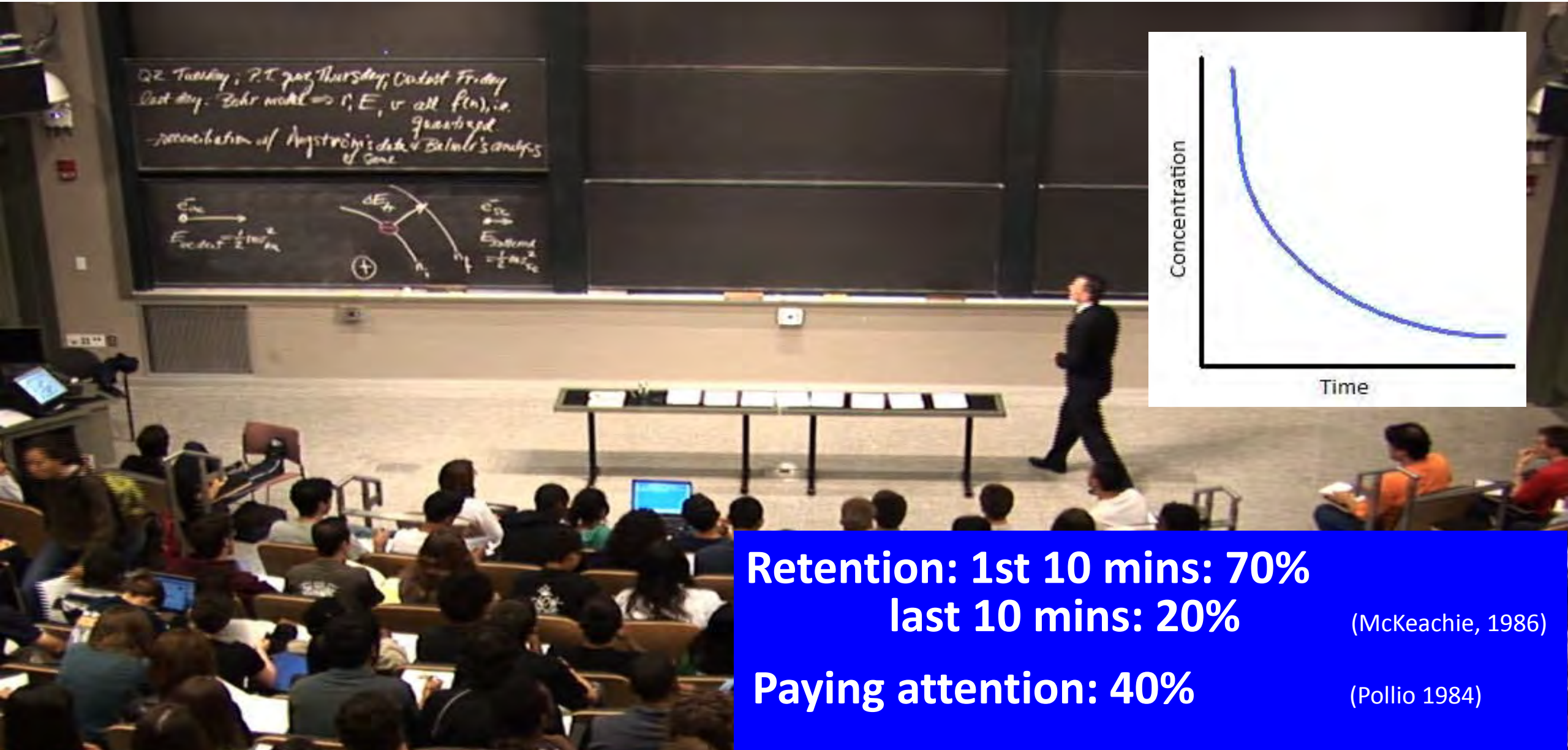
HOW?

Pedagogy & Culture

- Cohort-based, Active and Collaborative Learning
- Time and Space for Self

Lecture Hall Style Teaching

Passive and Impersonal



Retention: 1st 10 mins: 70%
last 10 mins: 20% (McKeachie, 1986)

Paying attention: 40% (Pollio 1984)

Course Overload

Drinking From the Fire Hose

No life outside the classroom


1 ST FLOOR
STAIRWAY 6
NO ROOF ACCESS
Terrascope 2013:
Reducing Atmospheric CO2
"Former MIT President Jerome Wiesner (1971-1980) coined this colorful description of the MIT educational experience:
'Getting an education at MIT is like taking a drink from a fire hose.'
Most students and faculty agree that the analogy is appropriate. ...In 1991, a group of hackers managed to embody this sentiment by turning a fire hydrant into a working drinking fountain in front of the largest lecture hall on campus, 26-100."
12/06/2014

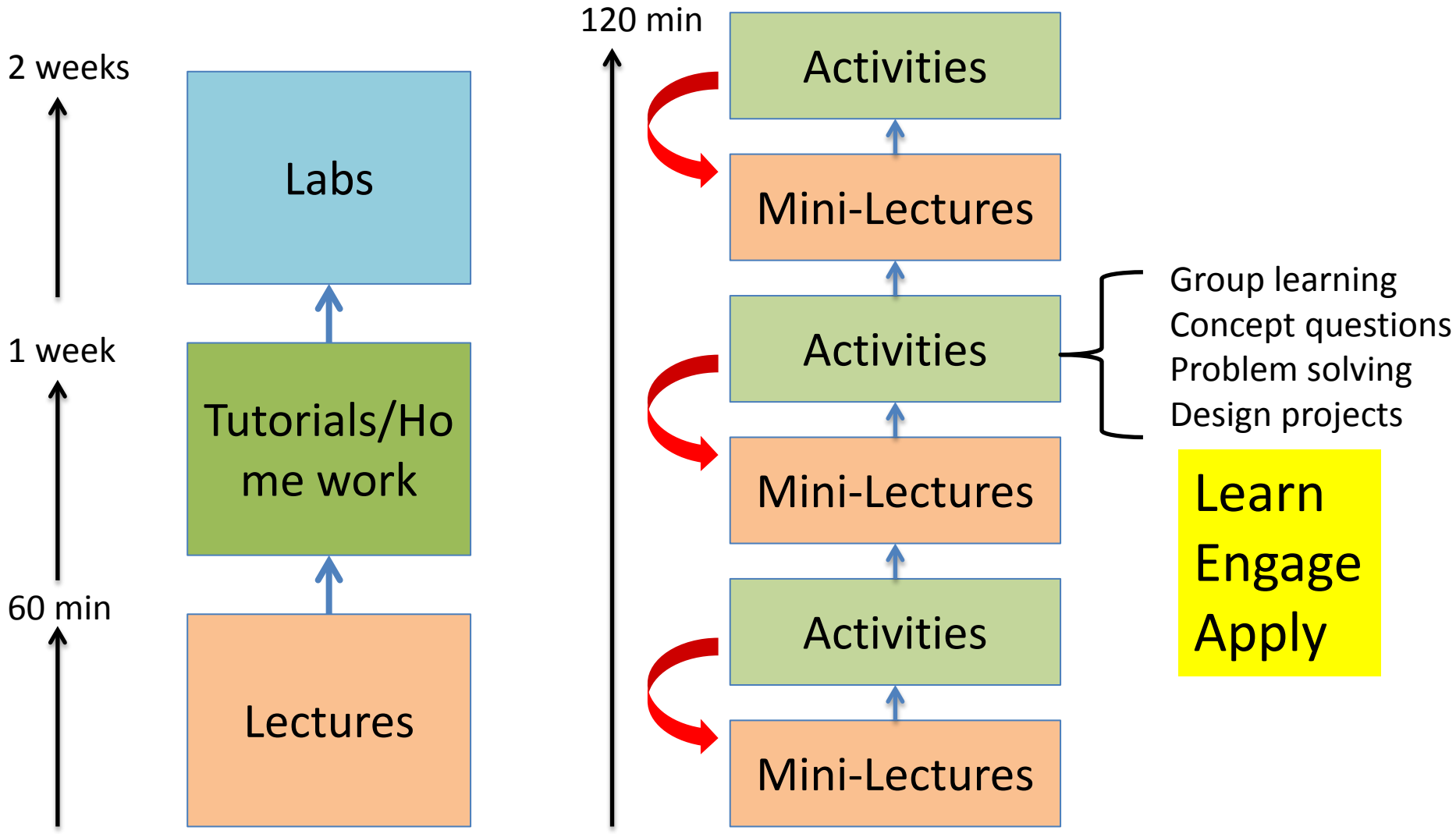
- Cohort-based, Active, Interactive and Collaborative Learning

  Creative thinking, Intense curiosity problem solving, multi-disciplinary mindset, team-work and collaboration

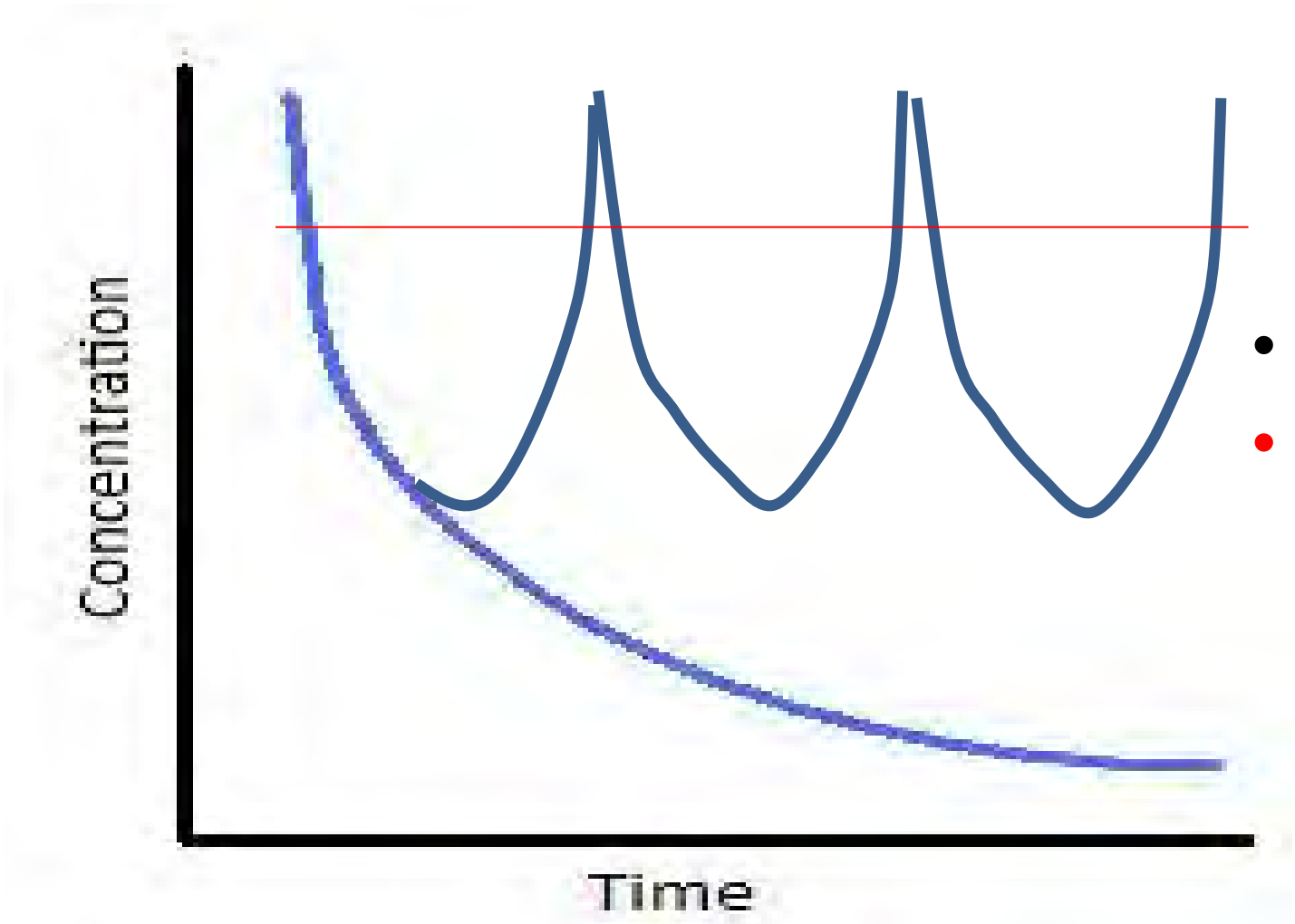
- Time and Space for Self

  Pursue passion and interests
  Get out of comfort-zone
  Leadership and entrepreneurship

Active and Interactive Learning



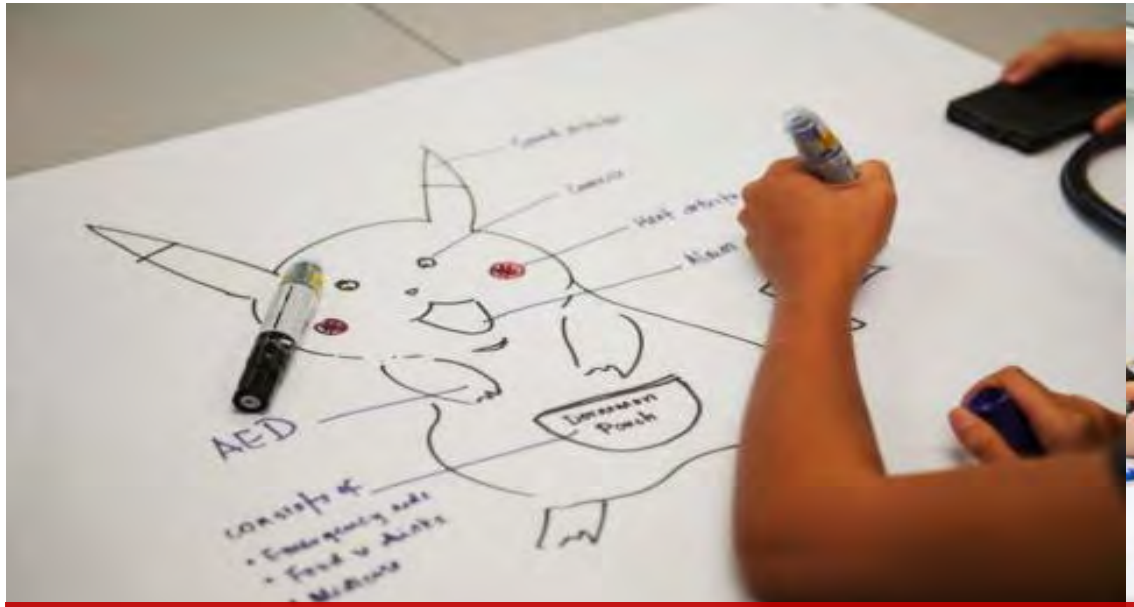
Active,Interactive and Collaborative Learning



- Sustained concentration level
- Group learning & peer support

Active and Collaborative Learning

- Student-faculty ratio of 11:1
- Nurturing faculty
- Integrating lectures, recitations and design projects (Learn, Engage and Apply)
- Group learning & peer support
- Ready access to fabrication equipment



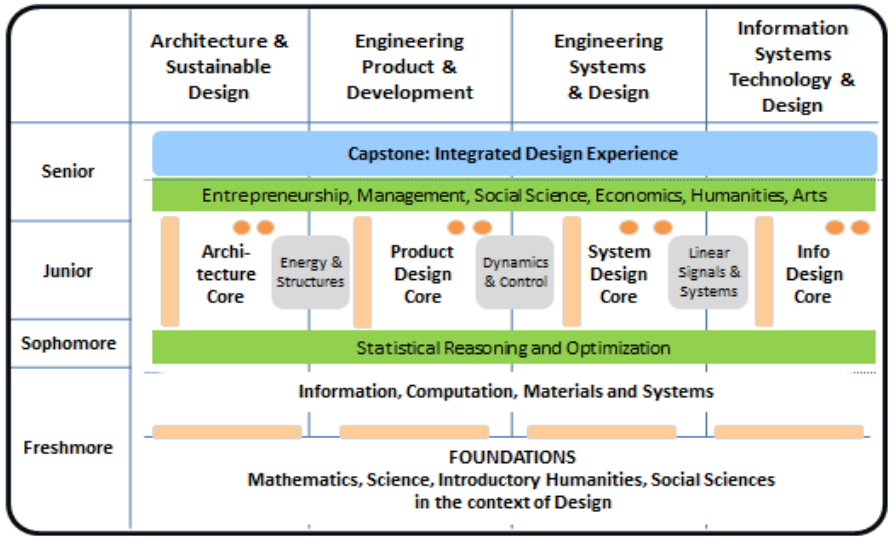
11:1 STUDENT-FACULTY RATIO. COHORT-BASED. DEDICATED CLASSROOM.

Hands on, Active Learning

PEER SUPPORT. TEAM-BASED LEARNING.

Time and Space for Self

Pursue passion and interests
Get out of comfort-zone
Leadership and entrepreneurship



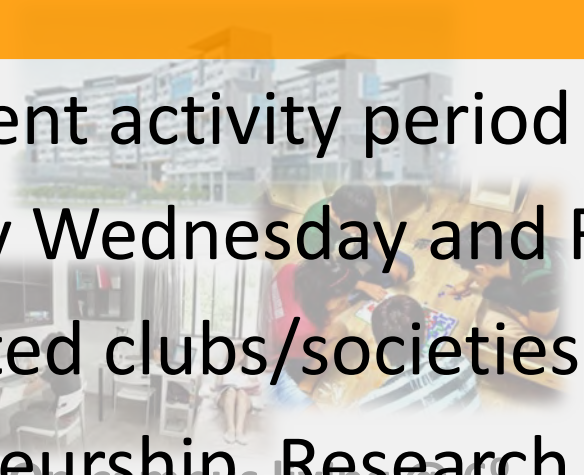
Outside-in curriculum

4 courses per semester

Fifth Row. 6º Residential Stay. Time and Space for Self.

Not an afterthought.

- Independent activity period (every January)
- Free every Wednesday and Friday afternoon
- Self-initiated clubs/societies
- Entrepreneurship, Research (UROP*)



On-campus living e.g.

Student Activities through the Fifth Row

*UROP: Undergraduate Research Opportunity Program

Fifth Row

- Co-curricular activities are often an afterthought; at SUTD, they are turned into a first-class activity – called the Fifth Row

- Fifth Row activities are designed to foster creativity:
  - Creative thinking: UROP*
  - Professional practice: UPOP*
  - Self-powered creativity: Clubs & Teams
  - Company creation: Entrepreneurship
  - Student Government (Root): Leadership
  - Having Fun: Hacking, dancing, living

** UROP – Undergraduate Research Opportunities Program; UPOP – Undergraduate Practice Opportunities Program*

SUTD Entrepreneurship Pathway

JAN – APR	MAY – AUG	SEP – DEC
	TERM1 STARTsomething	**TERM2** BUILDsomething
TERM3 LAUNCHsomething	**Break/ Exchange/ Internship**	**TERM4** hackathons/ Mentoring/ Incubation
TERM5 hackathons/ Mentoring /Incubation	**Break/ Exchange/ Internship**	**TERM6** Entrepreneurship Capstone Preparation Bootcamp
TERM7 Entrepreneurship Capstone	**TERM8** • Entrepreneurship Capstone Demo Day • Startup Pitch Day	

Startups
13 and **7** Incubating @ SUTD

Create4Good (Social Innovation) Pathway

JAN – APR	MAY – AUG	SEP – DEC
	Bootcamp & Call for proposals	Team forming leading to semi final selection
• Company formation • Prototype & business model development	• Final Judging • Top 3 teams given resources to further develop business	

FIFTH ROW - More than **84** student organisations ranging from **Performing Arts, Culture and Language, Engineering and Design to Community Service, the Arts, and Sports**

SUTD UROP

Undergraduate Research Opportunities Programme

Research Opportunities

UROP Project: The Omiboard (Electric Skateboard)

About 50% of Students participated in UROP

Faculty and students work together on creative projects

Great starting point

Apply theory into practice

Phases of research activity

Developing research plans, generating and analyzing data etc

Preparing Students for Future Careers

INTERNSHIPS (16 weeks)

Over **700** companies in partnership with SUTD

CAREER CENTRE

UPOP (career preparation courses), industry recruitment talks, etc.

POSTGRAD

Masters and PhD Programme

POTENTIAL CAREERS ACROSS DIVERSE SECTORS

Architecture

FMCGs

Finance

Consultancy

Telecomms

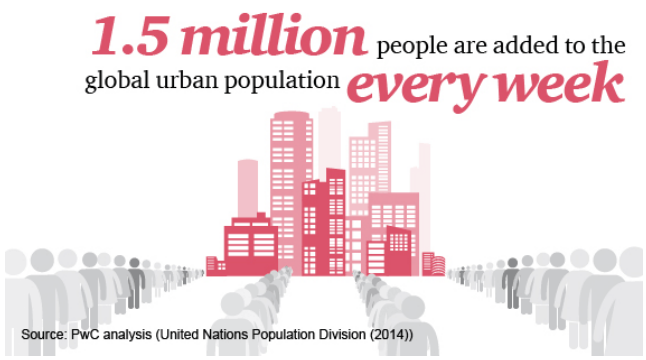
Energy/ Environment

IT/ Software

Logistics

Advanced Manufacturing

Conclusions



Rapid Urbanization

Global Warming

The 21st Century

Multi-faceted, global and societally-focused issues

Ageing Society

Security

4th Industry Revolution 2015 – Connected revolution: A ***digital transformation*** where everybody and everything is networked, sharing and processing information as a "huge brain"

Engineering education must continue to evolve to respond to the new challenges.

These include:

(1) Greater flexibility and diversification offered to students in their engineering studies (multi-disciplinary)

(2) The blending of on-campus active learning with off-campus online learning to scale up

(3) curricula that bring together cross-disciplinary learning, human-centred engineering and global outlook

Summary

1. We need a new, innovative pathway for nurturing technically-grounded leaders for a changing world.
2. SUTD has opted to try a different educational model of staying on the global front and staying relevant.
3. Will the SUTD model turn out to be an innovative and timely response to new needs and new paradigms for the 21st century?

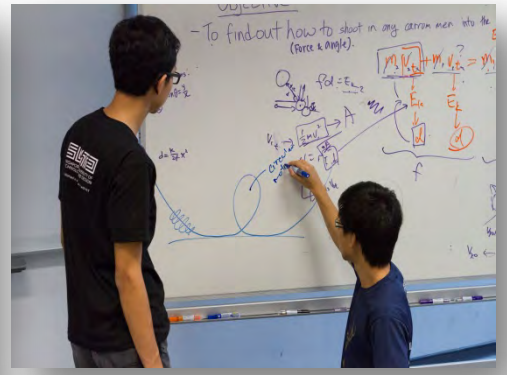
To put new wine into new bottles
新しい酒は新しい革袋に盛れ

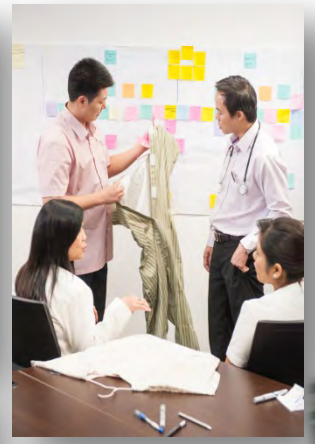
Our 1st batch of graduates are well received by wide industry sectors and graduate schools

Example of universities offering our students places in graduate studies:

Carnegie Mellon University · Columbia University · Cornell University Founded A.D. 1865 · Kellogg School of Management · LSE · UCL · University of Michigan · University of Minnesota · The University of Warwick

Think Big , Think Far….





“The quality of our expectations determines the quality of our actions”

- Andre Godin..

Aim High….

THE STRAITS TIMES SATURDAY, SEPTEMBER 20, 2014

SUTD's name scales new heights

Virgin Himalayan peak to bear name of university after students climbed it

By AMELIA TENG

IN THE last few years, Mr Samuel Chin has heard people ask the same questions about his school, the Singapore University of Technology and Design, or SUTD.

What is it? Is it a new university? Where is it located?

So the 23-year-old third-year student and seven male undergraduates decided to fly their school flag, way up high.

Last month, they reache
6,056m virgin peak – one tha
human has ever set foot on
the Indian Himalayas.

If approval is granted,
mountain at Karcha Nala, a va
in the state of Himachal Prad
will be called Mount SUTD. T
are also getting permission
name the mountain pass and
base camp after the university

Climbers of virgin peaks name them and register the names with the local authorities. They are believed to be the first students here to achieve such a feat, although Singapore has made its mark elsewhere in the world through such expeditions before.

In 2005, three mountains in Central Asia were christened Temasek, Singapura and Ong Teng Cheong after prominent climber David Lim and three Singaporean mountaineers scaled the peaks

On top of gym sessions and runs every week, they spent two to three hours every Saturday hiking up Bukit Timah Hill, each carrying a load of 18kg.

They also climbed two peaks earlier to train up. The first in January was to DaFeng, which is among the Siguniang Mountains in China's Sichuan province, and the second was in May to India's Friendship Peak in Himachal Pradesh.

For Mr Chin, the desire to scale a mountain came after a trekking trip in Nepal a few years ago. "I saw so many peaks and I thought I would want to climb one."

Mr Te, 24, said he wanted to

(From left) Mr Te, Mr Chin and their team members climbing the mountain that will soon be named after SUTD. They are
URTESY OF CHUA WEI ZHEN

assion and risk-taking
UTD the first universi-
mountain named after

next time Mr Chin is
t his school, his reply
be different. "It is the
which has a mountain
r it," he said.
.com.sg

"You never conquer the mountain, You only conquer yourself."

Jim Whitaker

First American who climbed Mount Everest

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Established in collaboration with MIT

Thank You

Nurturing Technically-gounded Leaders and Innovators

Creative ● Passion for technology and design ● Multi-disciplined ● Risk-takers

“Someone with passion, ability and dreams to go and do something that is going to change the world.”