



International Conference
The Future of Education

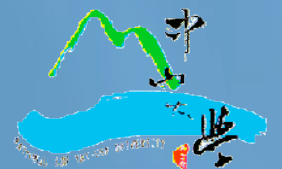
Edition 8

Florence, Italy, 28-29 June 2018

Connecting Engineering Education in Universities to the Real World

Chi-Cheng Cheng, Chua-Chin Wang, Ying-Yao Cheng
National Sun Yat-sen University, Kaohsiung, TAIWAN, R.O.C.

This work is funded by the Ministry of Science and Technology, Taiwan,
Republic of China under grants MOST 105-2511-S-110-007-MY3.



AGENDA

- **Background**
- **The Interdisciplinary Talent Development Project**
- **Strategies of Other Universities**
- **Teaching Innovation of Teachers**
- **Concluding Remarks**



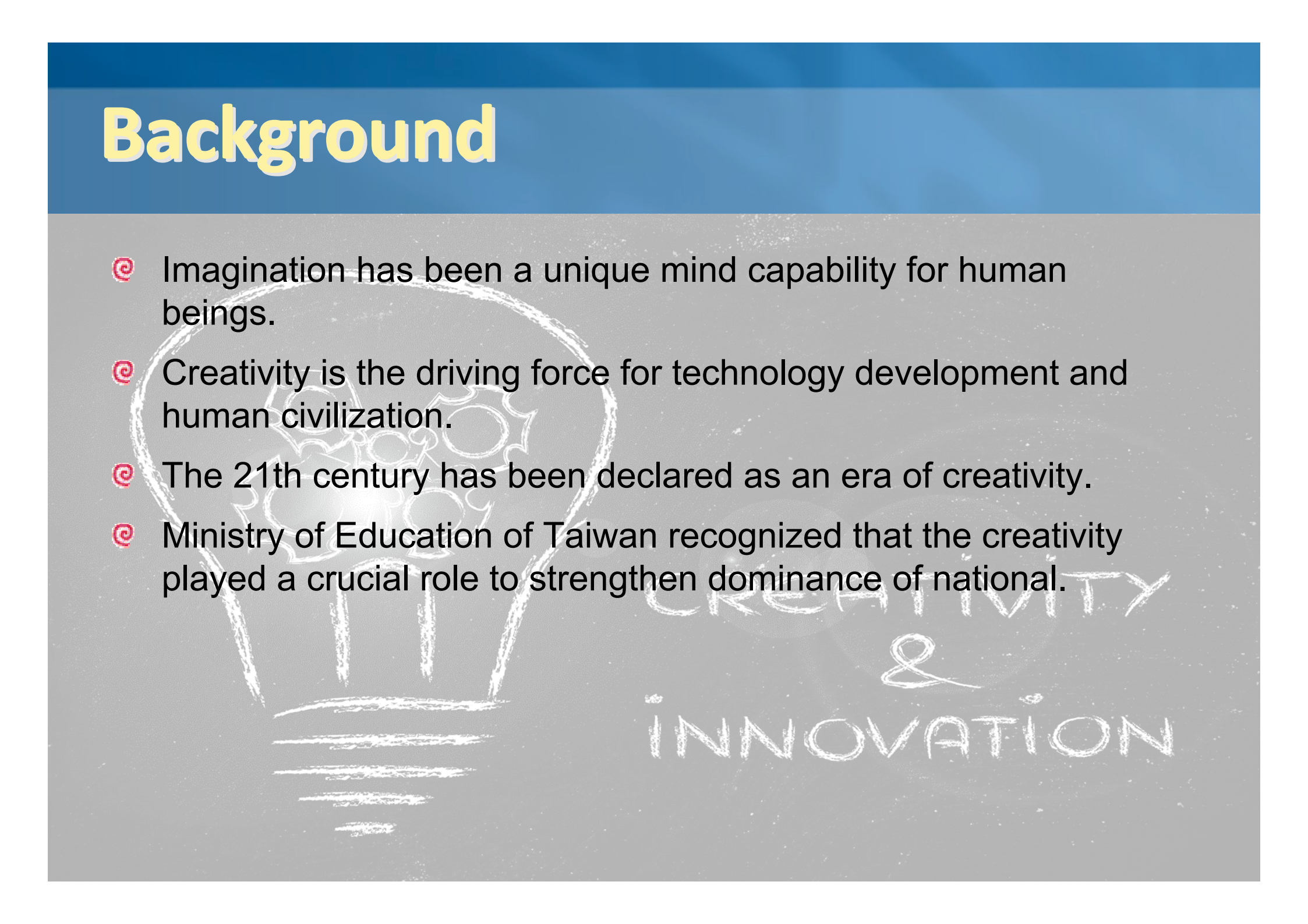
Taiwan's situation

- ② Taiwan is a small island located at western Pacific Ocean.
- ② Taiwan greatly relies on *human resources* more than other countries due to lack of natural resources.



Background

- ① Imagination has been a unique mind capability for human beings.
- ① Creativity is the driving force for technology development and human civilization.
- ① The 21th century has been declared as an era of creativity.
- ① Ministry of Education of Taiwan recognized that the creativity played a crucial role to strengthen dominance of national.



CREATIVITY
&
INNOVATION

Medium-range development plan for creative education

- @ Creative teachers
- @ Creative students
- @ Creative campus
- @ Creative think tank
- @ Creative academic training
- @ International mobility
- @ Regional creativity
- @ Creative high schools
- @ Intelligent ironman creativity contest
- @ Creative development and practice
- @ Creativity evaluation

Ministry of
Education of
Taiwan since 2000



Creativity in Taiwan's education

- ② *The Ministry of Education (MOE)* in Taiwan has promoting cultivation of *creativity* and *innovation* in all levels of schools for more than one decade.
- ② The white paper on creativity education by MOE announced six action plans in 2002. The ultimate goal for creative education is to build a Republic of Creativity (ROC).
- ② According to The Global Competitiveness Report 2014-2015 released by the World Economic Forum, Taiwan has ranked as *top 10* in 144 economies in the world in terms of *the innovation index*.



Traditional engineering education

- @ Engineering education always focuses on expertise knowledge and skills for future needs in professional domain.
- @ Deeper and broader coverage in engineering education to strengthen students' engineering capabilities becomes the goal of almost all universities.



Assessment and Teaching of Twenty-First Century Skills Project (ATC21S)

- @ launched at the Learning and Technology World Forum held in London in January 2009
- @ Six founder countries including Australia, Finland, Portugal, Singapore, England, and USA with three major technology companies in the world, Cisco, Intel, and Microsoft
- @ **Ten skills** are classified into four groups: **ways of thinking, ways of working, tools for working, and living in the world.**
- @ The crucial 21st century skills listed in the group of ways of thinking consist of **creativity, innovation, critical thinking, problem solving, decision-making, and learning to learn.**

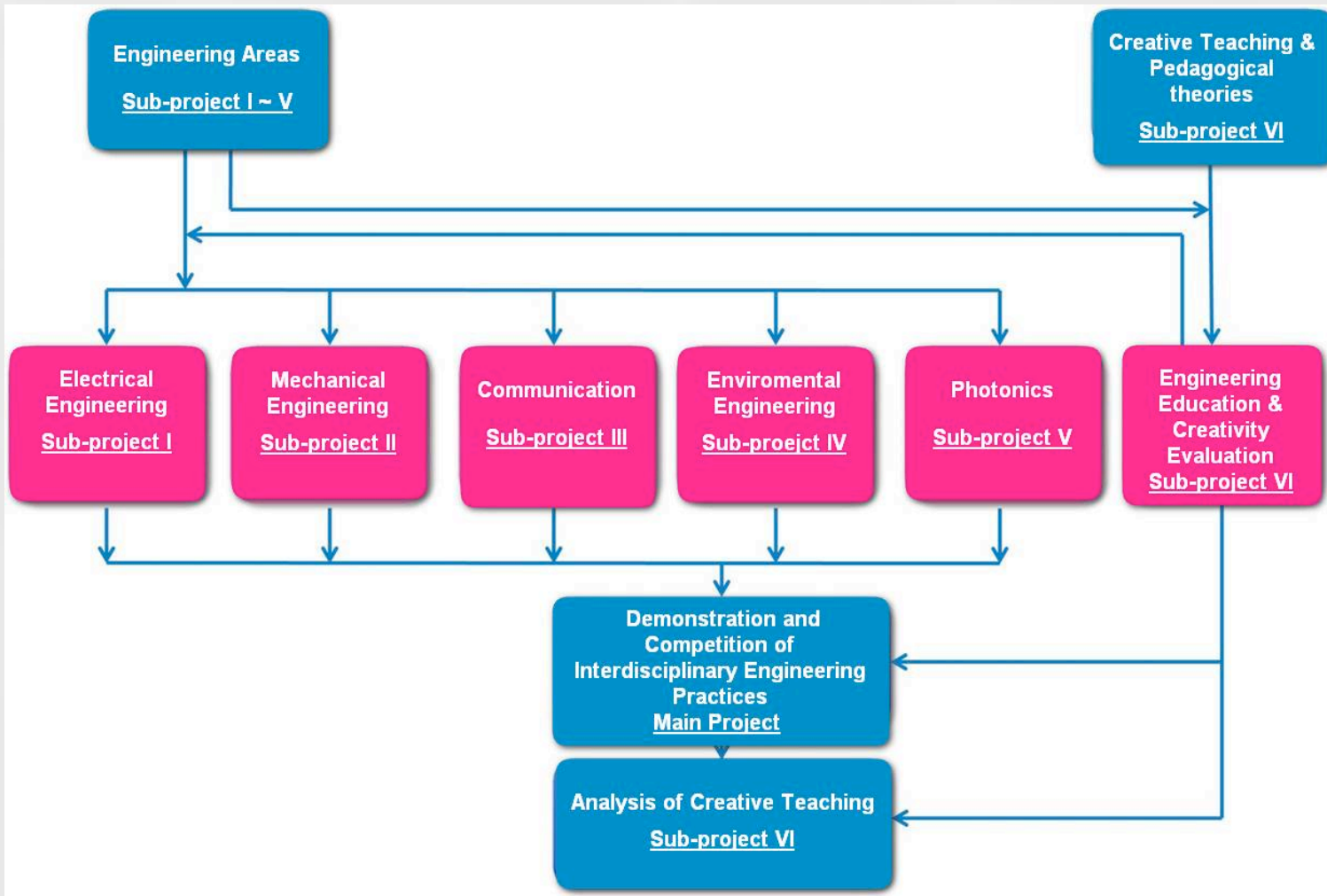


The Imagination Research Projects Program

- @ Sponsored by the *Ministry of Science and Technology* (MOST), Taiwan
- @ The **College of Engineering** and **Institute of Education** in National Sun Yat-Sen University are responsible for conducting a three-year integrated project under this program.
- @ This integrated project tries to analyze the development of creativity in selected courses in the College of Engineering.
- @ Project duration: December 2014 – November 2017



Project framework



Teachers with innovative thinking?

- ② Project achievement and performance was greatly restricted because of unclear cognition and understanding of creativity and innovation for participating teachers.
- ② Teachers did not act the most important role to inspire creativity and imagination of students.
- ② Teachers also need to be persistently educated in many aspects in order to possess sufficient knowledge and capability to guide students for future engineering education.



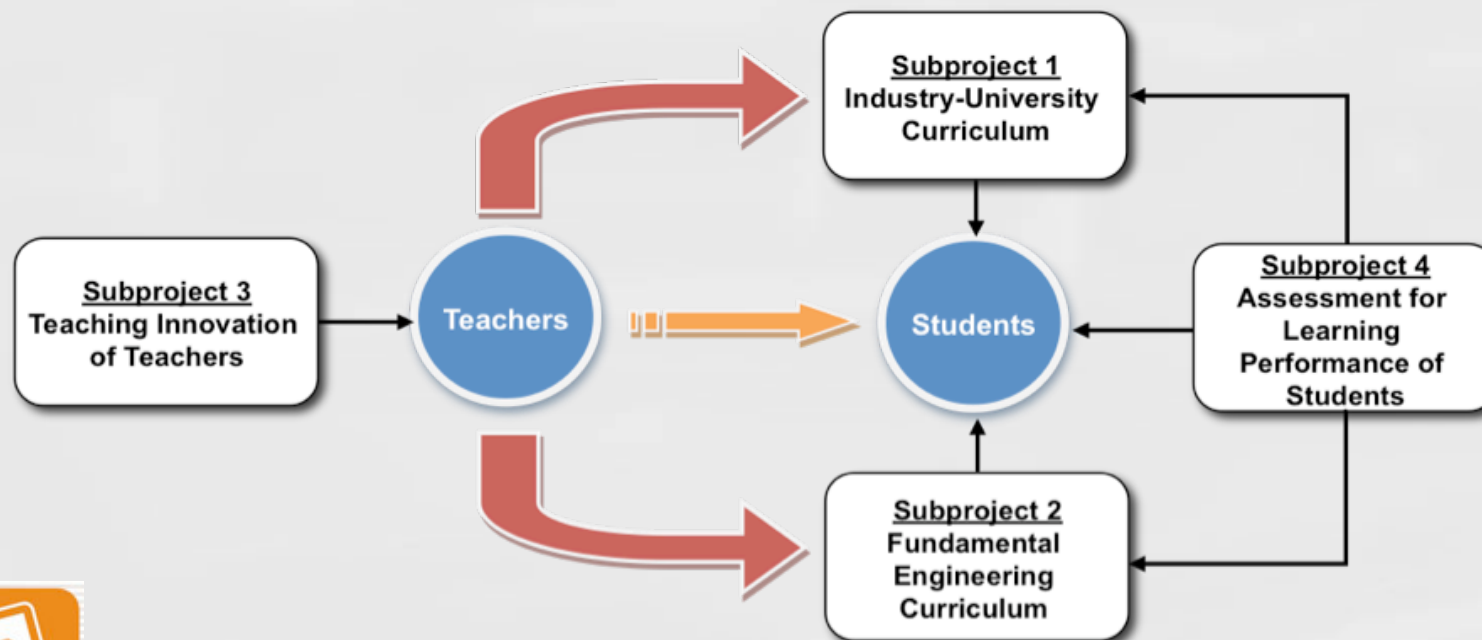
Motivation and objective

- A new three-year interdisciplinary talent development project sponsored by MOST started in December 2016.
- Continue previous project by embedding imagination and innovative thinking into current engineering curriculum.
- An additional objective: Connect engineering education in universities to the real world



The Interdisciplinary Talent Development Project

✿ The subproject 3 is the only subproject on teachers' side with the objective of enhancement of teachers' growth and progress especially on creativity and innovation.



Strategies of other universities

In order to allow engineering research accomplishment can respond to industrial needs, educational institutions also endeavor to fill the gap between academic theorems and practical engineering.

- Massachusetts Institute of Technology

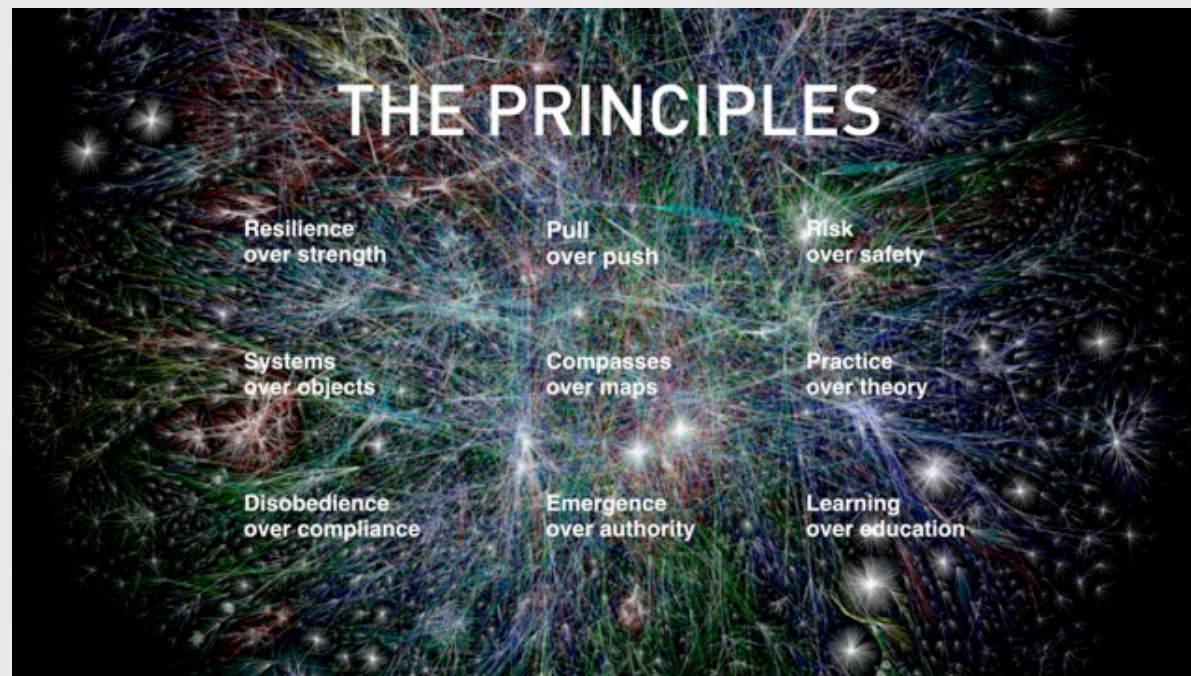


- Stanford University



The Media Lab - MIT

- The media laboratory in Department of Architecture and Urban Planning, established in 1985, aims to promote anti-disciplinary research culture by breaking boundary of existing academic fields. They encourage **unconventional approaches** especially cooperation between media arts and technology.



The Deshpande Center - MIT

- Under the College of Engineering of MIT, a Deshpande Center for Technological Innovation was founded in 2002. This center is market-oriented and provides a platform to commercialize innovations from all members in the school.
- The mission of the MIT Deshpande Center for Technological Innovation can be summed up in one word: **IMPACT**.

MIT | **DESHPANDE CENTER**
FOR TECHNOLOGICAL INNOVATION



Keller Center - Princeton University



- Keller Center formed in the School of Engineering and Applied Science in 2005
- It emphasizes interdisciplinary integration of engineering, humanities, arts, social sciences, and natural sciences.
- All the curriculums are constructed from four key dimensions including **create**, **learn**, **explore**, and **engage**, to strengthen students' creativity and connection between classrooms and industry.



CREATE



LEARN



EXPLORE

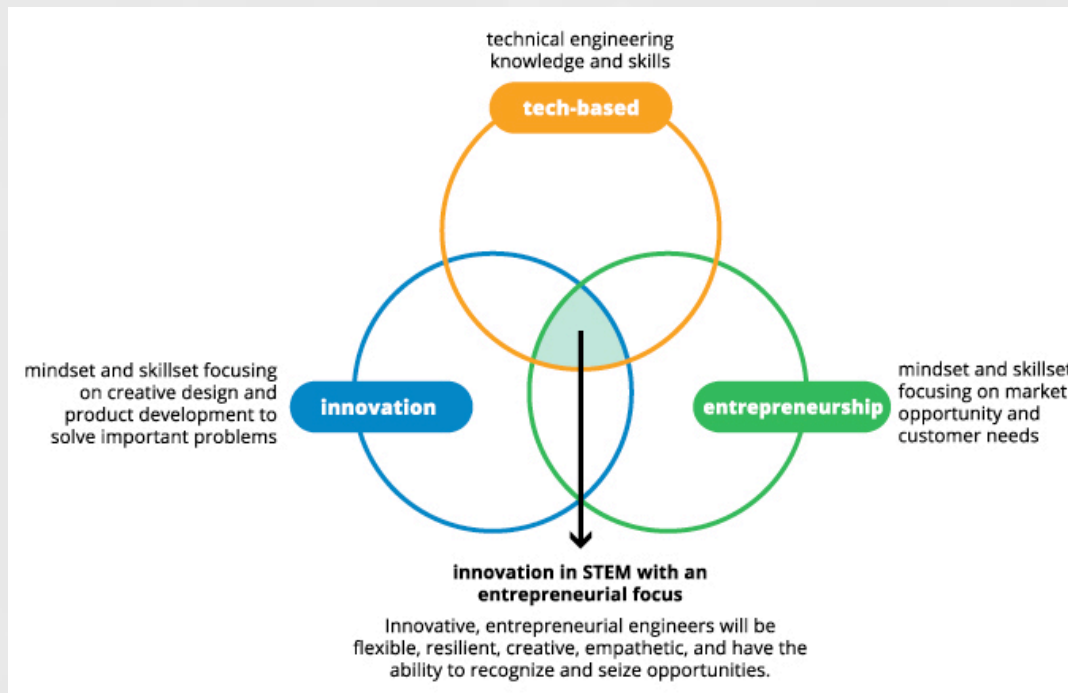


ENGAGE



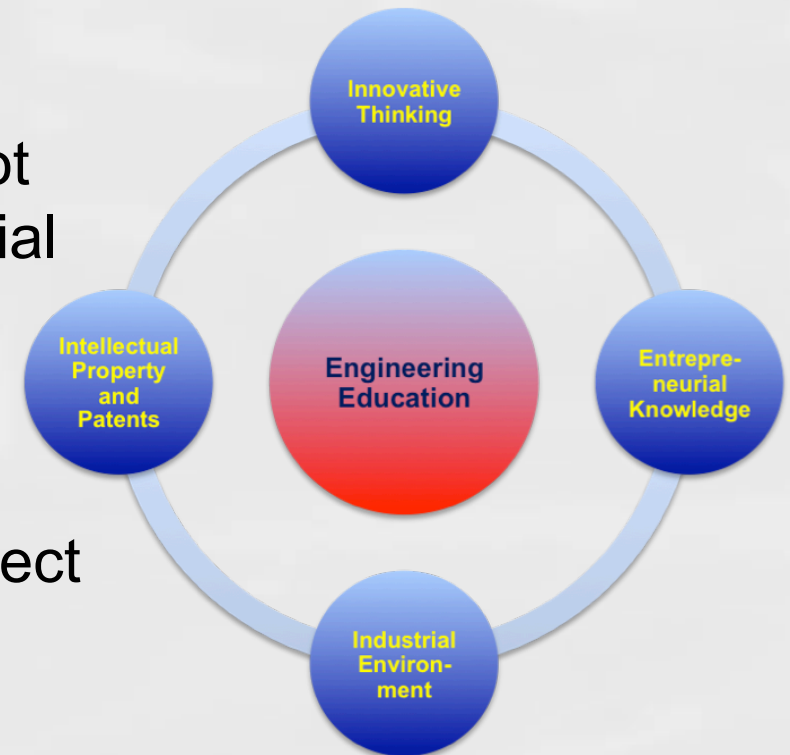
Epicenter - Stanford University

- Stanford University established the Epicenter sponsored by National Science Foundation in 2012. The objective of the Epicenter is to let engineering students be capable of understanding entrepreneur and innovation, which will produce significant effect in their future, in their college life.



Teaching innovation of teachers

- **Innovative thinking** – Only products with innovative ideas own market values.
- **Entrepreneurial knowledge** – Most engineering faculty members were not educated with sufficient entrepreneurial knowledge.
- **Industrial environment** – Engineering teachers have to follow market trend and industrial movement to have correct decision making.
- **Intellectual property and patents** – Protect originality and collateral benefits of the innovation.



Duties of Engineering Teachers

- Traditional engineering education may not be enough for engineers in 21st century.
- The responsibility of engineering teachers in 21st century is not only to instruct pure engineering knowledge, but to guide and connect the students to the industry in real world.
- The subproject 3 entitled “Teaching innovation of teachers” aims to help engineering teachers developing their knowledge enlargement along those four dimensions.



Concluding Remarks

- Engineering knowledge and skills are not sufficient for college students in 21st century to link with industry.
- Innovation, imagination, and problem-solving capability are important to connect engineering education in universities to the real world.
- Non-engineering skills for engineering education in 21st century can be classified into four dimensions: **innovative thinking**, **entrepreneurial knowledge**, **industrial environment**, and **intellectual property and patents**.



**Thank you very much
for your listening!**



Campus of NSYSU & Kaohsiung harbor

