



國立清華大學



# Crossing-Border Journey of E-Learning Education 4.0 & Future Landscape of Higher Education

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National Tsing Hua University  
May 24, 2018



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# Outline

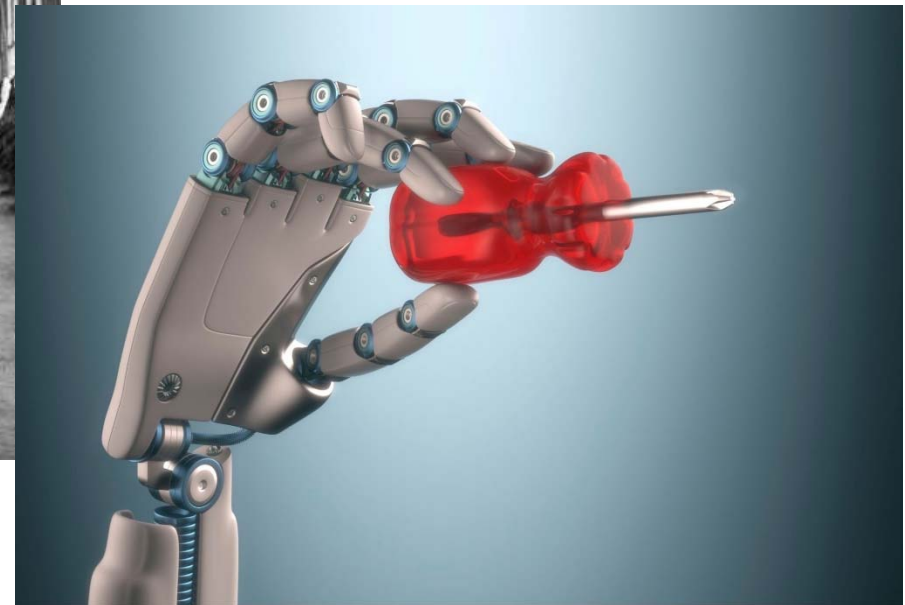
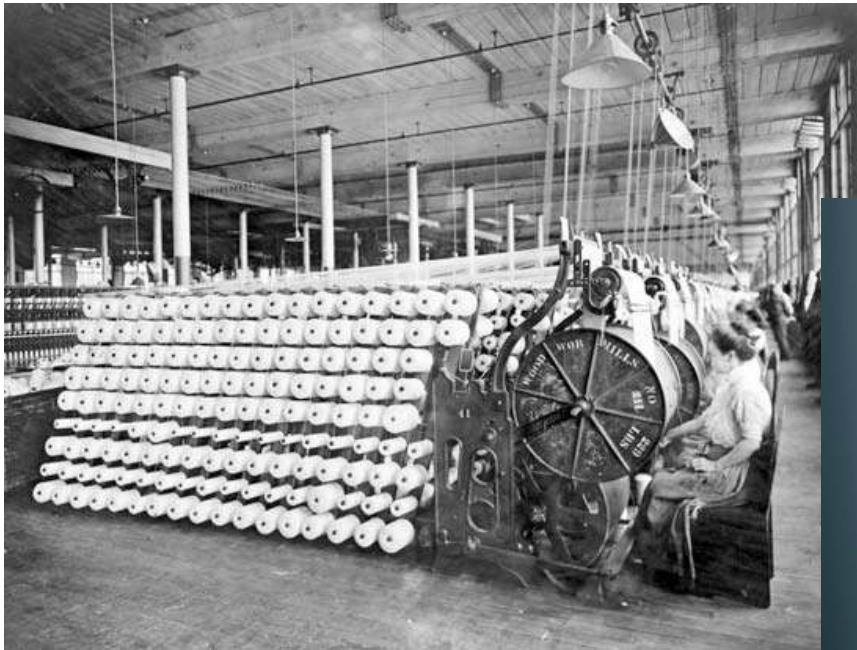
- **Industry** from 1.0 to 4.0
- **Education** from 1.0 to 4.0
- **Future Landscape of Higher Education**

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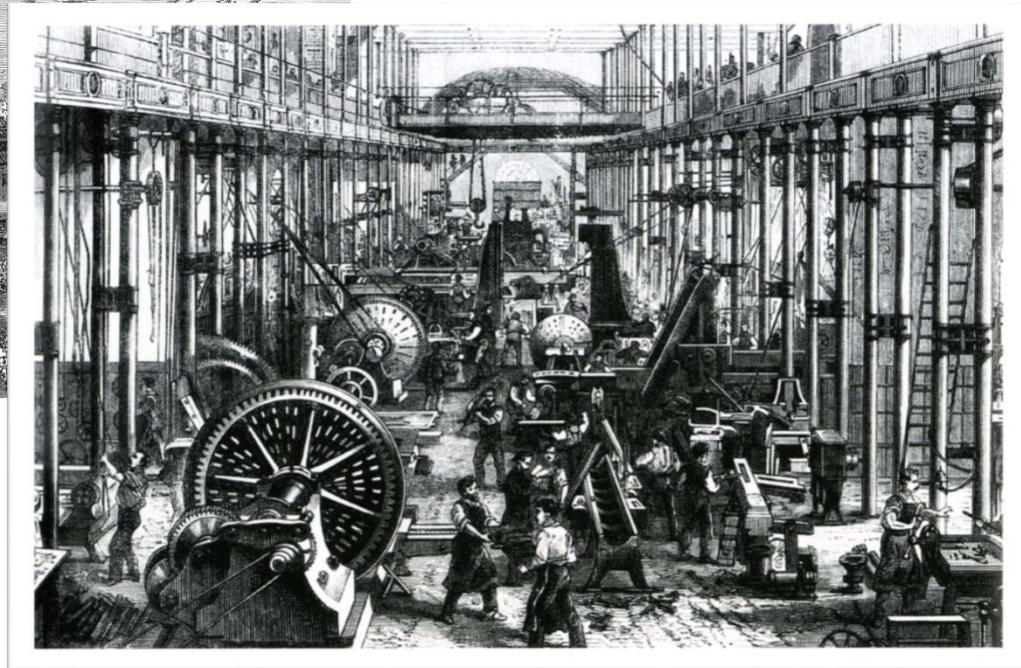
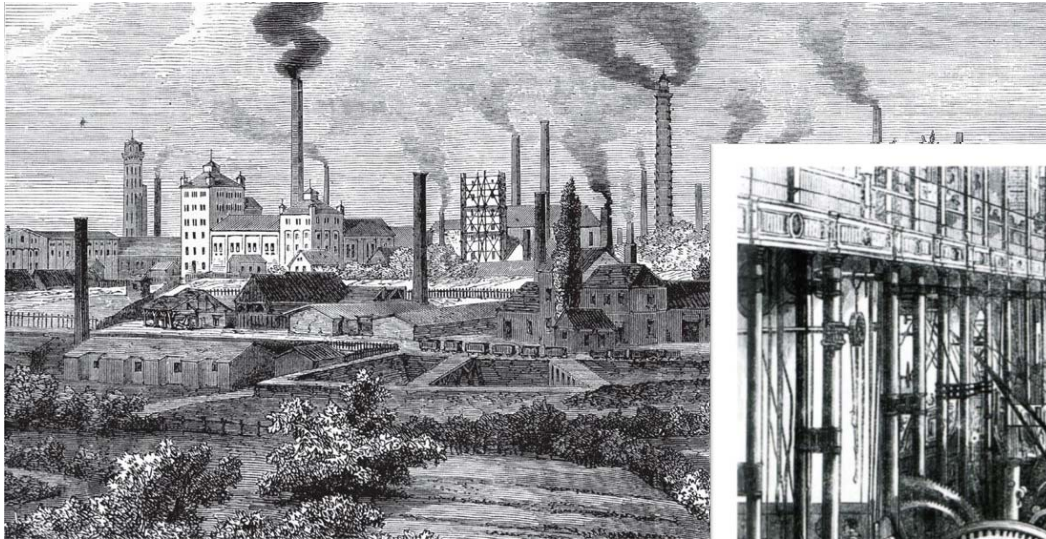
# Cross-linked Industry and Education

- **Industry** facilitates education and inspires the need for education
- **Education** supports/drives the development of industry

# Industry is Evolving...

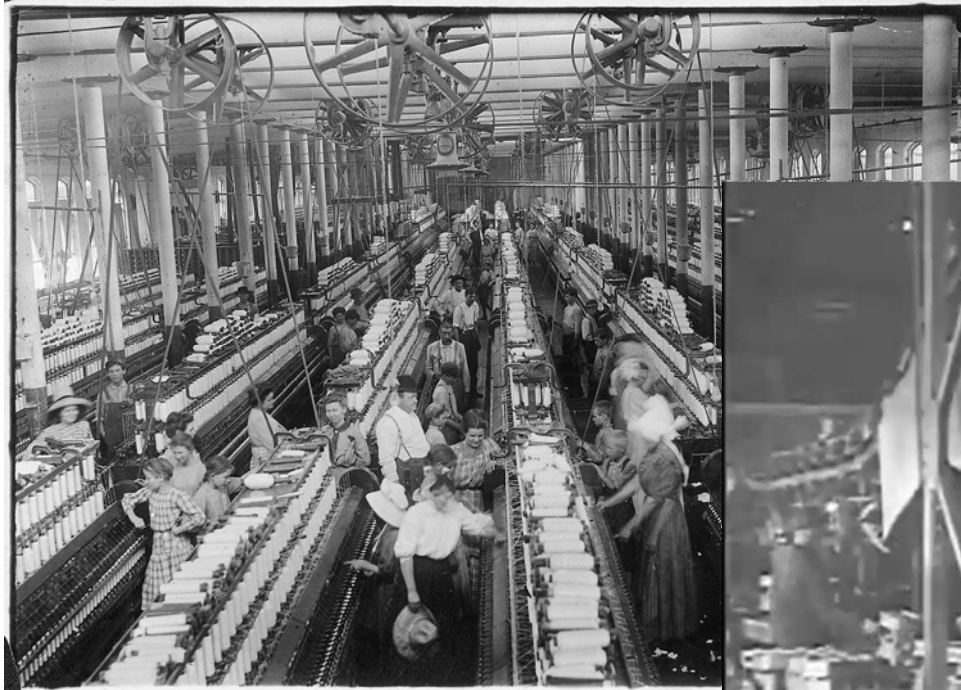


# Industry 1.0 - Steam Power Replaces Manual Production



Left: <http://evans9j.blogspot.tw/2015/04/introduction-to-industrial-revolution.html>  
Right: [https://commons.wikimedia.org/wiki/File:Hartmann\\_Maschinenhalle\\_1868\\_\(01\).jpg](https://commons.wikimedia.org/wiki/File:Hartmann_Maschinenhalle_1868_(01).jpg)

# Industry 2.0 - Mass Production Setup



Ford Model A Assembly  
([Video](#))

Left: [https://commons.wikimedia.org/wiki/File:Hartmann\\_Maschinenhalle\\_1868\\_\(01\).jpg](https://commons.wikimedia.org/wiki/File:Hartmann_Maschinenhalle_1868_(01).jpg)

Right: [https://www.youtube.com/watch?v=PZnGWJ\\_6BwU](https://www.youtube.com/watch?v=PZnGWJ_6BwU)

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# Industry 2.0 - Mass Production Setup

**And time marches on into  
the late afternoon.**

Chaplin Modern Times-Factory Scene ([Video](https://www.youtube.com/watch?v=7vRe56EwFf4))

<https://www.youtube.com/watch?v=7vRe56EwFf4>

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# Industry 3.0 - E-Technology Automated Mass Production





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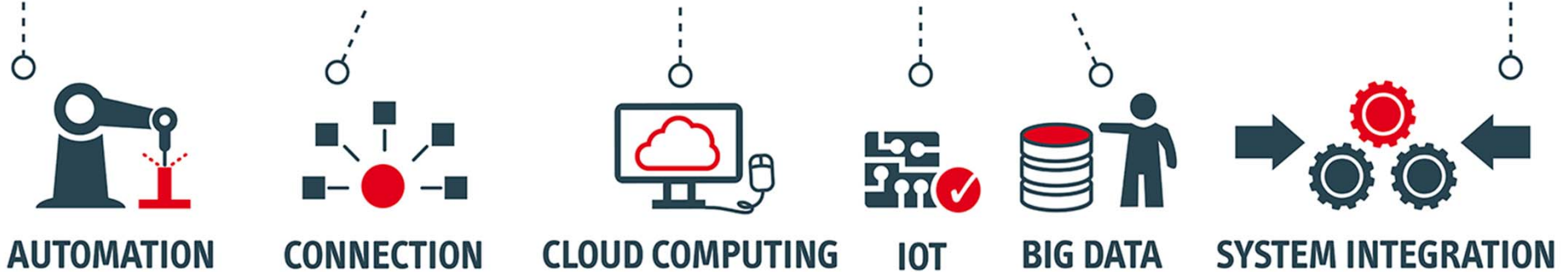
# Industry 3.0 - E-Technology Automated Mass Production



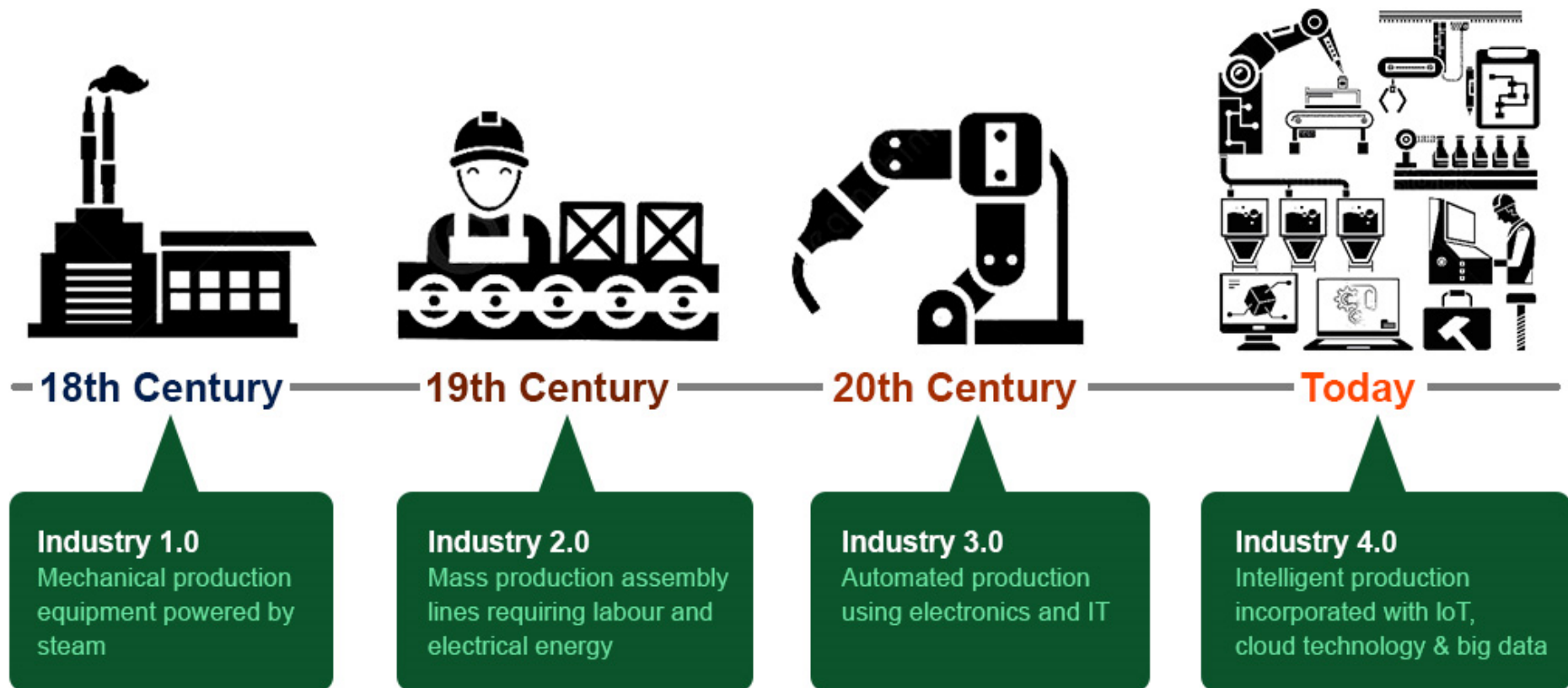
Robots Builds Cars ([Video](#))

# Industry 4.0 - Cross-linked Production and Up-/Down-stream

## INDUSTRY 4.0



# Industrial Revolutions 1.0 to 4.0



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# Industry 4.0



[Video](https://www.youtube.com/watch?v=ktcRXyE8SaY)

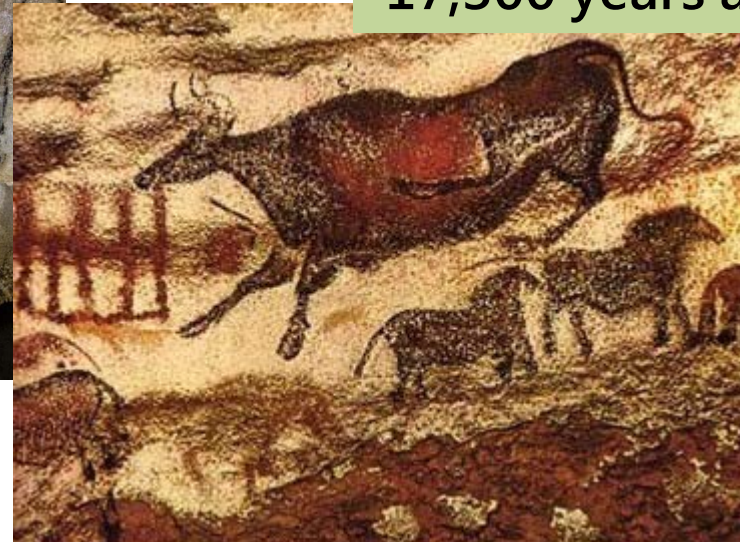
<https://www.youtube.com/watch?v=ktcRXyE8SaY>

# Education 1.0 – Symbols Replace Oral in Knowledge Transfer

Paleolithic Writing  
石壁刻紋  
40,000 – 10,000 years ago



Lascaux  
岩洞壁畫  
17,300 years ago

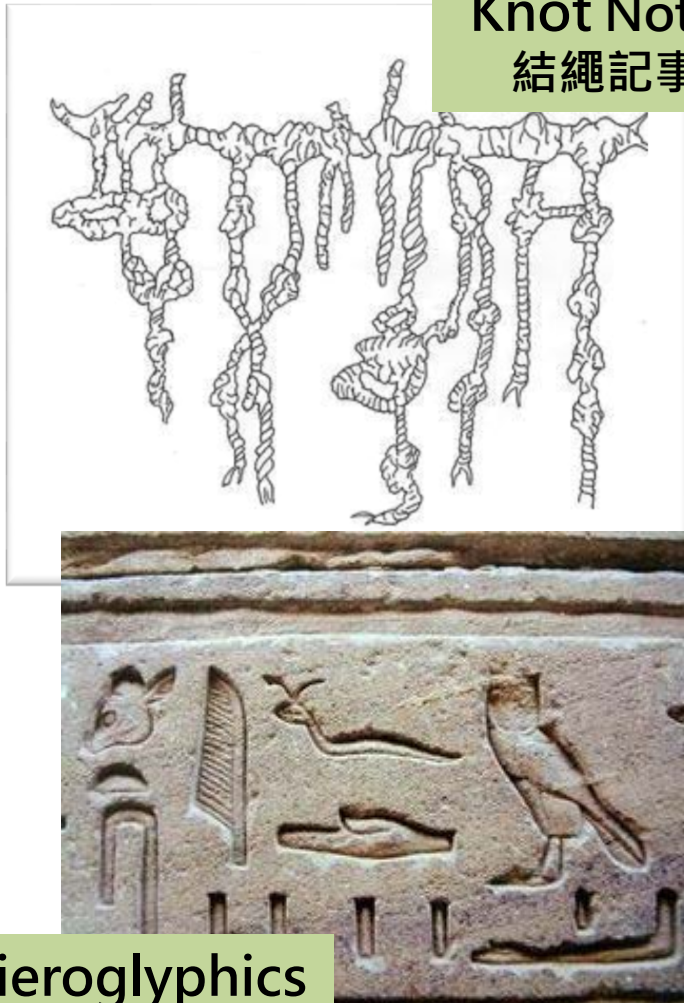


Lascaux: <https://en.wikipedia.org/wiki/Lascaux>

Cave Writing: <https://news.nationalgeographic.com/2016/05/cave-art-ice-age-paleolithic-writing-first-signs/>

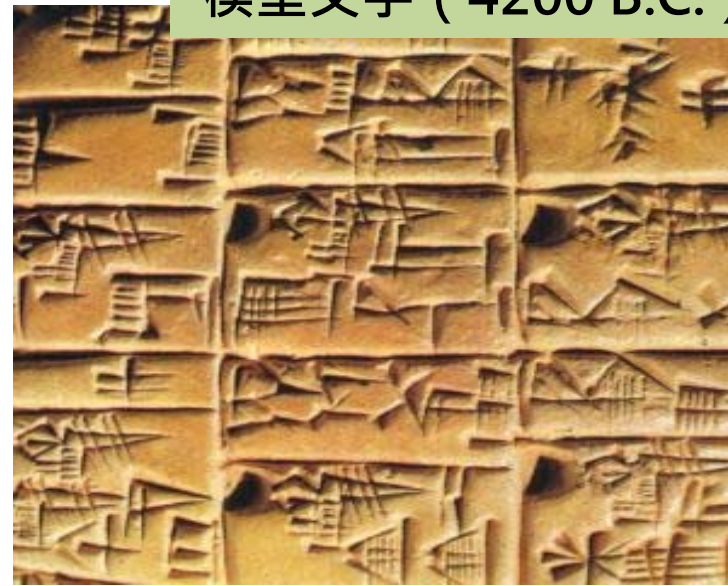
# Education 1.0 – Symbols Replace Oral in Knowledge Transfer

Knot Notes  
結繩記事



Hieroglyphics  
象形文字

Cuneiform  
楔型文字 ( 4200 B.C. )



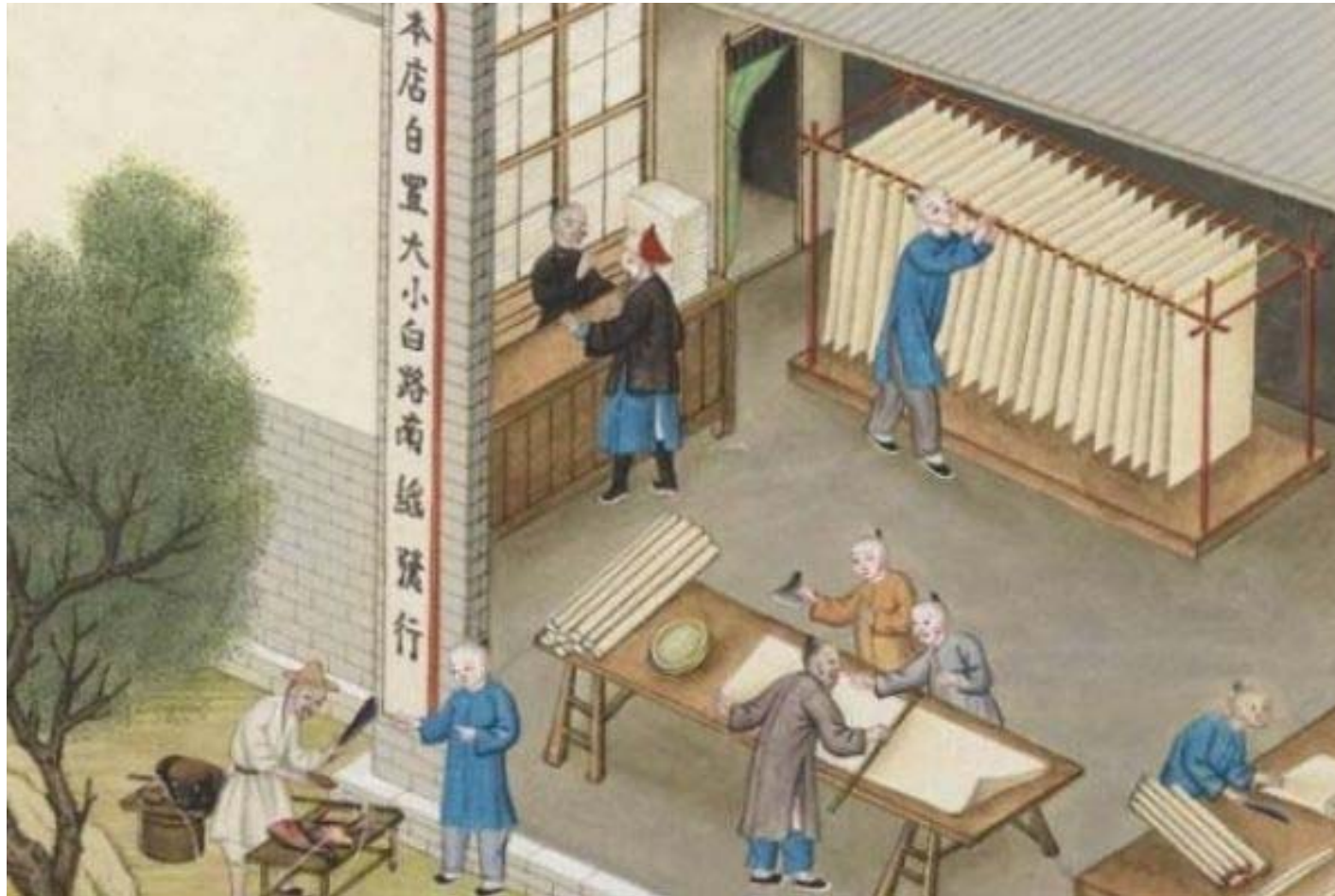
Knot notes: [www.sohu.com/a/206181678\\_99897111](http://www.sohu.com/a/206181678_99897111)  
Hieroglyphs: <https://en.wikipedia.org/wiki/Hieroglyph>  
Cuneiform: <http://www.ohmygod.org.tw/waterball.aspx?ARID=A2012021100005>

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# Education 2.0 – School Setup / Mass Education for Write and Read

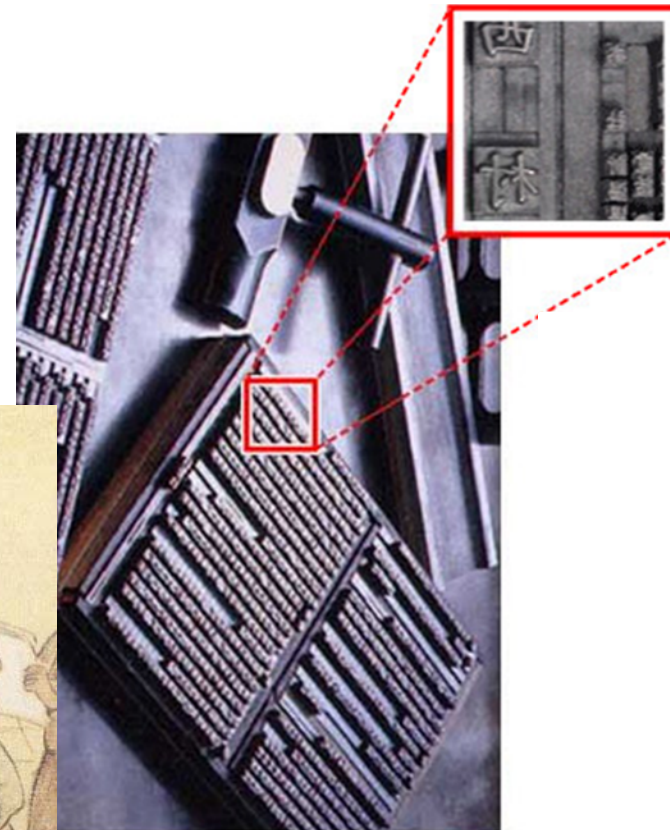


# Education 2.0 - Paper-making Technology





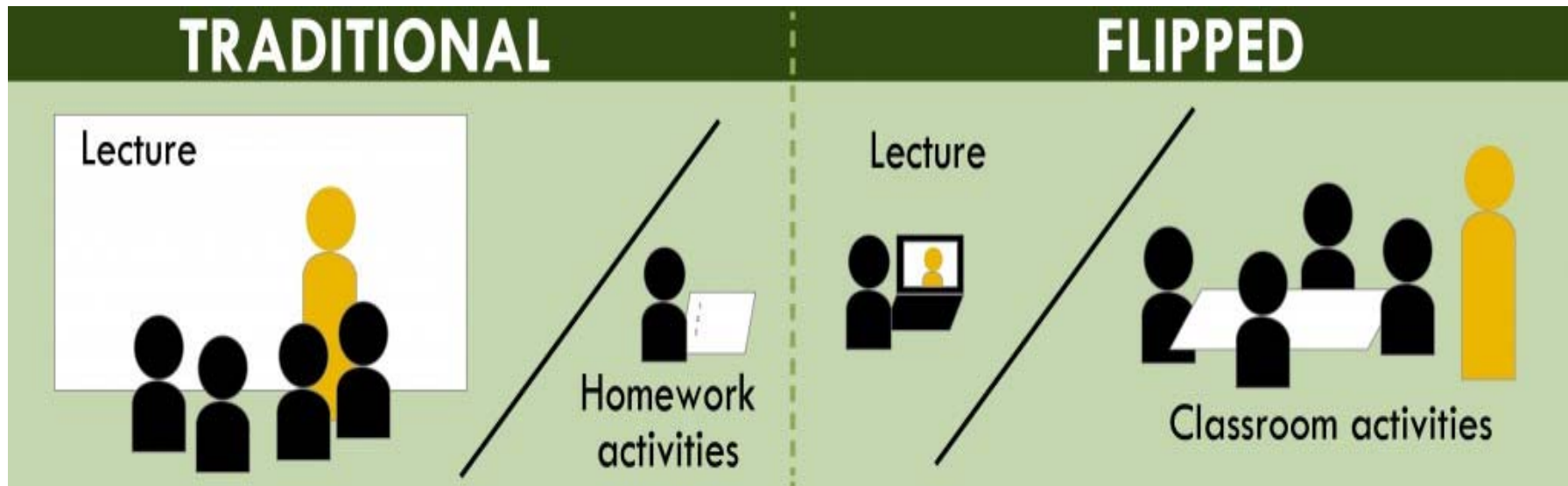
# Education 2.0 - Printing Technology



Left: [http://blog.sina.com.cn/s/blog\\_6f98e9a90101jbly.html](http://blog.sina.com.cn/s/blog_6f98e9a90101jbly.html)

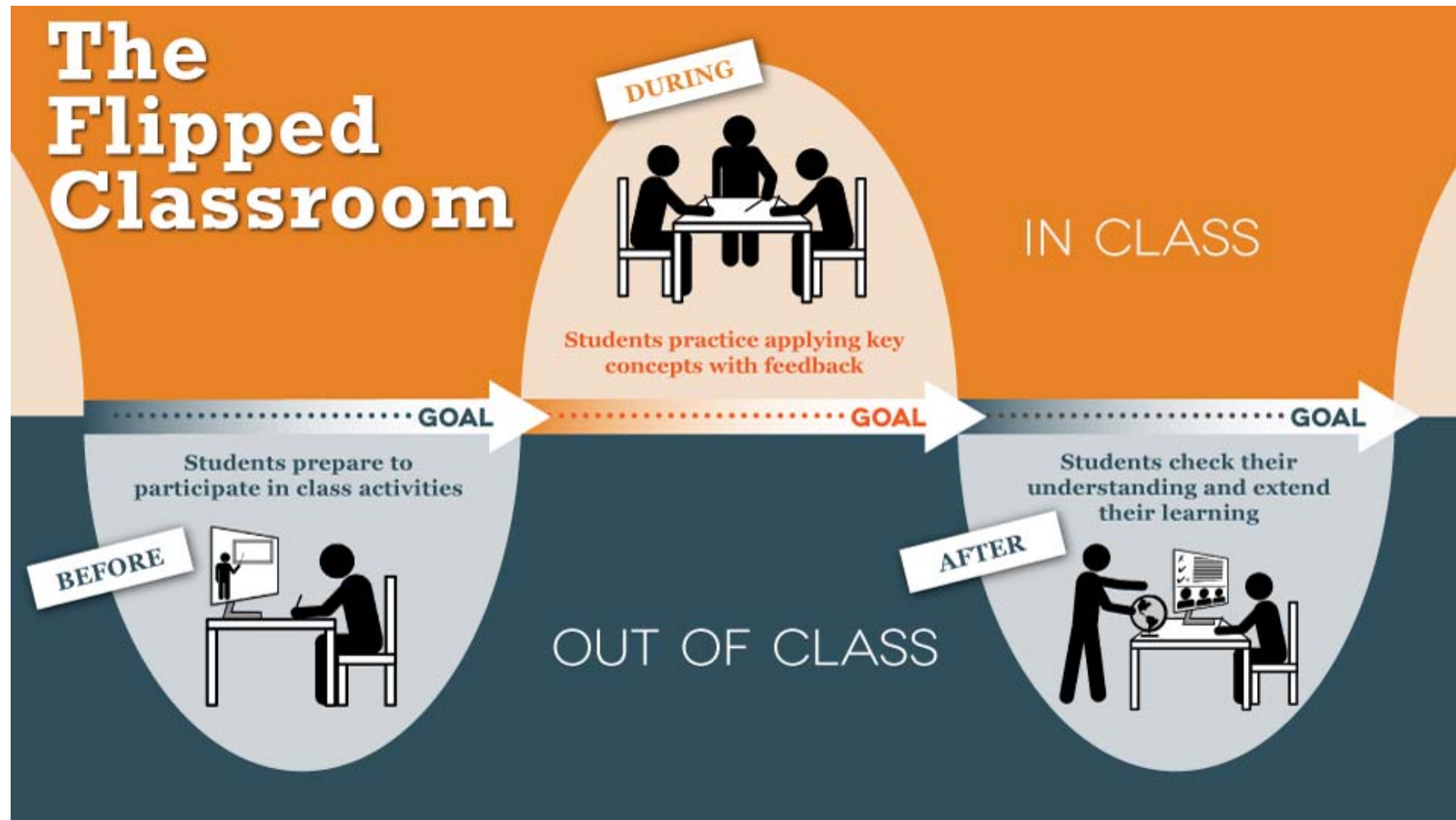
Right: <http://www.niigata-printing.or.jp/zoominprinting/katuji.html>

# Education 3.0 - E-Technology Enabled Flipped Classroom



<https://www.washington.edu/teaching/teaching-resources/engaging-students-in-learning/flipping-the-classroom/>

# Education 3.0 - E-Technology Enabled Flipped Classroom



# Education 4.0 - Cross-linked Learning: IoT, Cloud and Big Data



# Industry and Education from 1.0 to 4.0

- Analogy and Correlation -

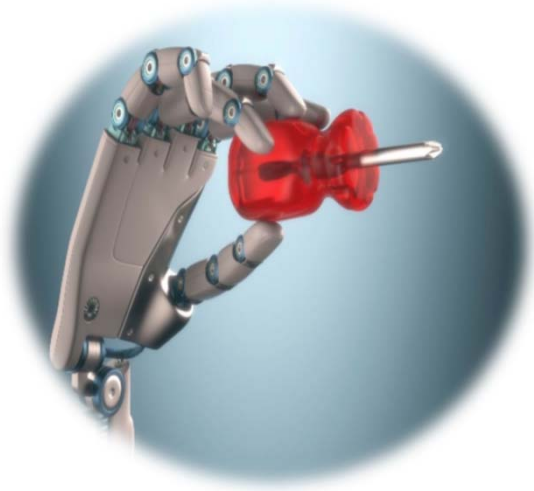
	Industry	Education
1.0	Power facilitating production	Media facilitating knowledge transfer
2.0	Mass production	Mass education
3.0	Self-control production by e-technology	Self-control Learning by e-technology
4.0	Cross-linked customized production	Cross-linked customized education

# Higher Education: Landscapes Down the Road



# Where Are We in Higher Education?

Industry 4.0



**Higher Education Remains  
at 2.0 towards 3.0 !**

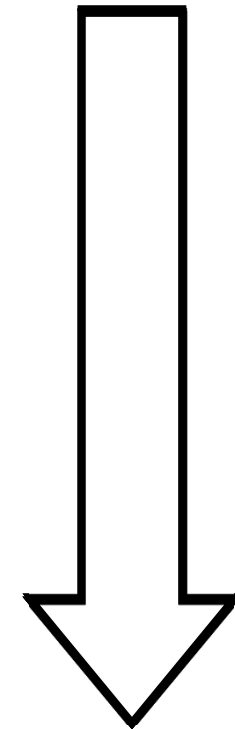
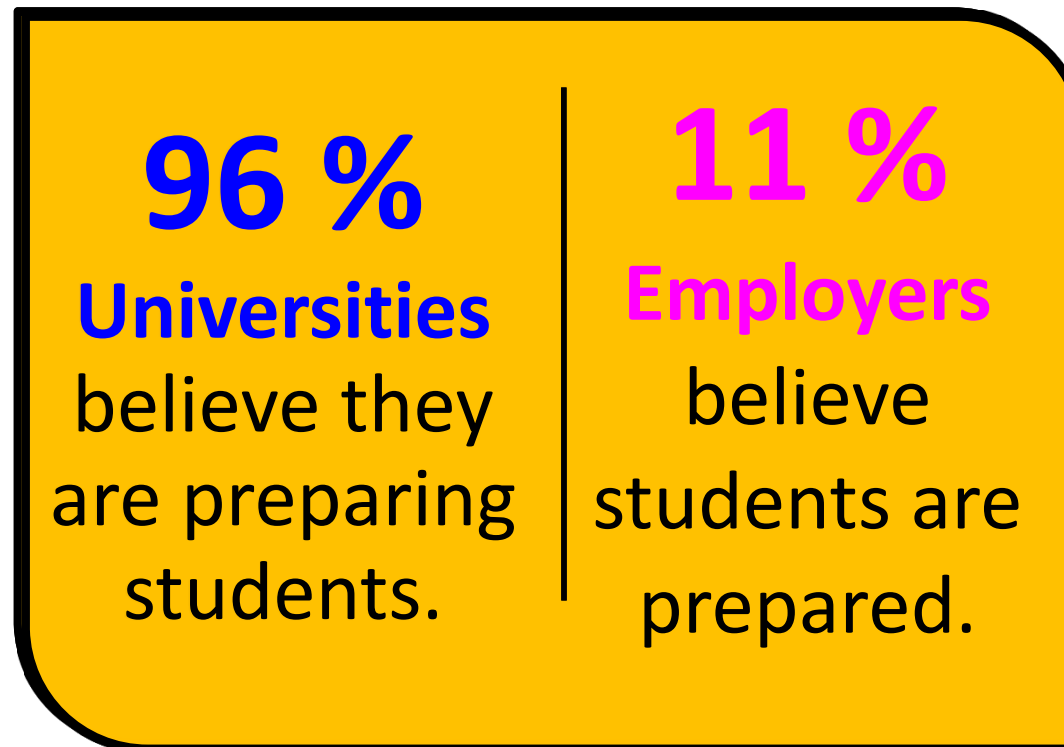
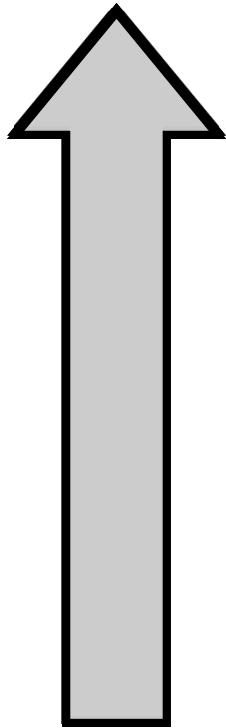
- Standardized Learning?
- One-way knowledge transfer?
- Efficiently-trained, high quality labor?



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# 2014 Gallup Poll

- Gaps between U.S. Higher Ed and Employers



<https://tw.alphacamp.co/2017/03/21/minerva/>

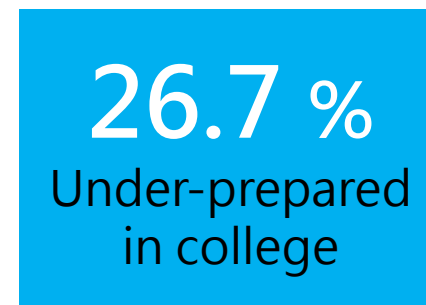
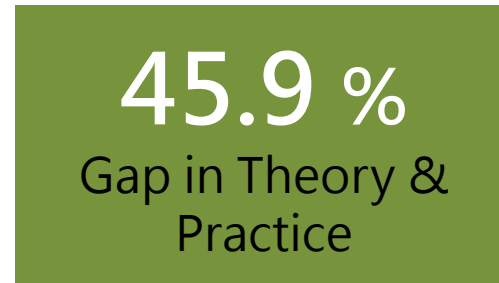
Source: 2014 Gallup Poll



# Taiwan 1111 Human Resource Bank (2017)



Of employees indicated **gaps** between higher education and first job



# Higher Education Challenges

Issues	Reasons
Outdated Learning Materials	<ul style="list-style-type: none"><li>• Education systems established before the emergence of e-technology.</li><li>• <b>Shift</b> from knowledge-transferred learning to competence-based exploration (analyzing, synthesizing and independent thinking skills)</li></ul>
Outdated Pedagogy	<ul style="list-style-type: none"><li>• One-way lecturing remains dominant</li><li>• <b>New Ways of Learning</b>: Peer instruction, active learning, etc.</li></ul>
Failure to meet the Demands of Globalization	<ul style="list-style-type: none"><li>• Closed-loop campus</li><li>• <b>Need for exposure to diversity of experiences and perspectives</b></li></ul>
Soaring Tuition	<ul style="list-style-type: none"><li>• Inflation rate of 115% over 40 years before 2014, while college tuition in America <b>increased 489%</b>.</li><li>• Prestigious colleges not emphasizing teaching</li></ul>

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# 3D Printing

## Market to Double by 2020

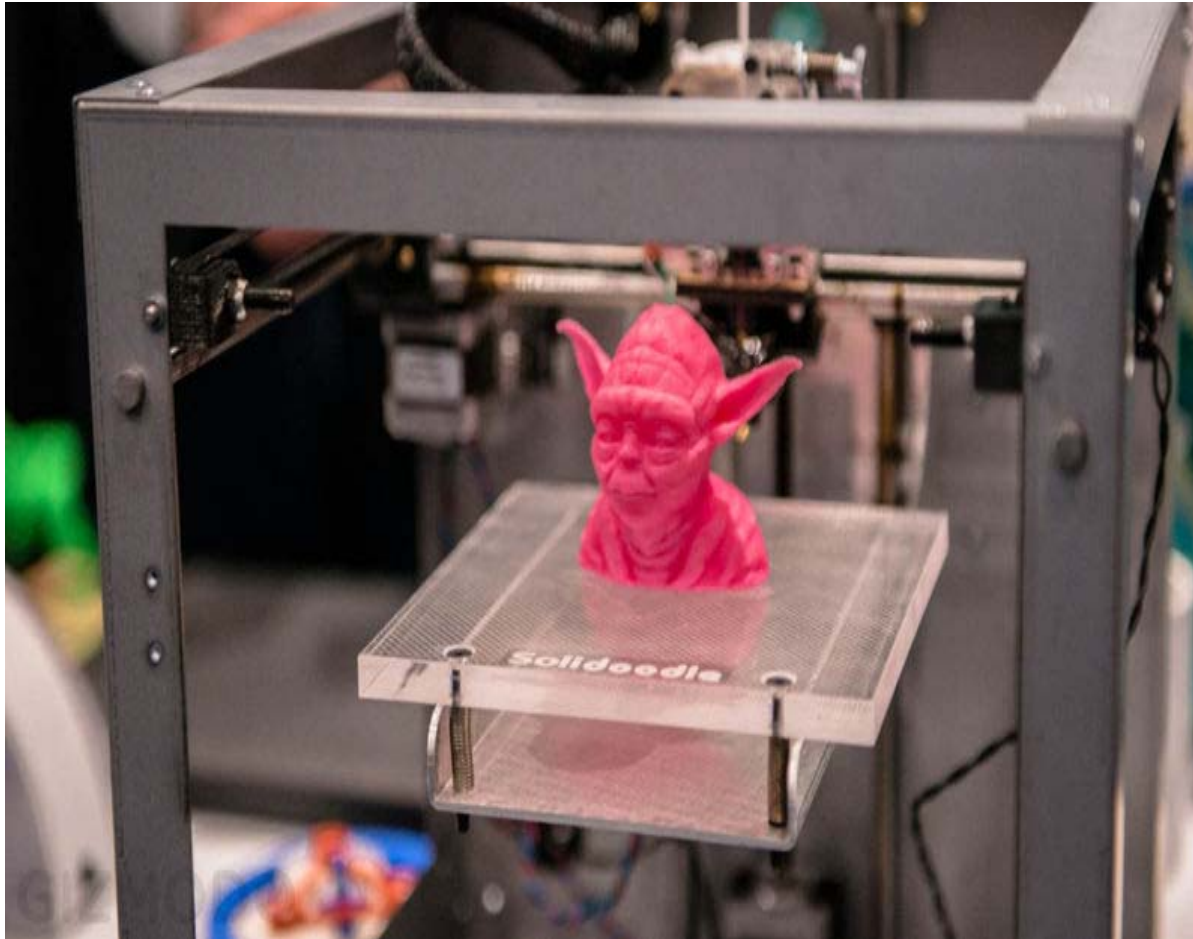


<https://campustechnology.com/articles/2016/08/17/report-3d-printing-market-to-double-by-2020.aspx>

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# 3D Printing

## customized making



<https://campustechnology.com/articles/2016/08/17/report-3d-printing-market-to-double-by-2020.aspx>

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# 3D Printing

Feb 21, 2017 , UC students build 3D-printed prosthetic hands for kids



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# Virtual Reality

## in Medical Education



<http://bestvirtualreality.com/img/VirtualRealitymedical.jpg>

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# Free Open Courses

June 20, 2016, reach to the unreachable



<http://www.usnews.com/news/articles/2016-06-20/coursera-on-a-mission-to-help-refugees>

# Next Classroom

## cross-linked & customized



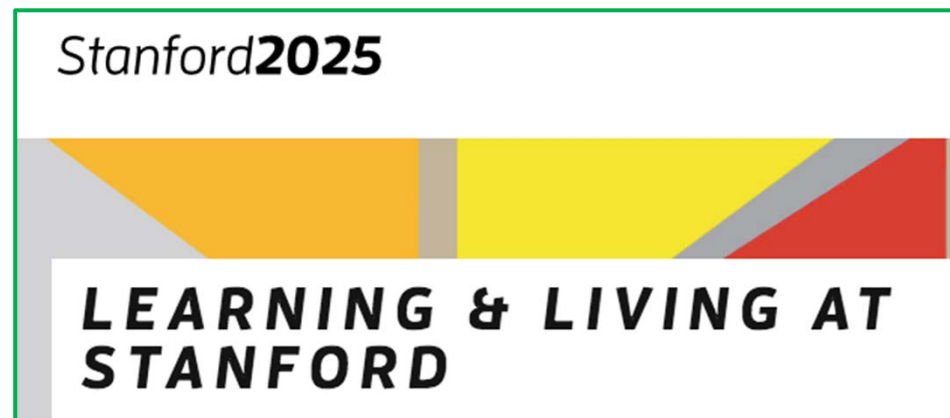
- 1 互動式觸控螢幕  
**Interactive touch screen**
- 2 AVer 無線實物攝影機/投影機 & 一對一教學  
**Wireless Object Projector /1:1 Learning**
- 3 充電同步車/櫃  
**Fast charging cart**
- 4 教室用視訊會議攝影機 (遠距教學錄播系統)  
**Video-conferencing camera**
- 5 AVer 實物攝影機 (亦稱實物投影機)  
**Object projector**
- 6 A+ Suite 軟體  
**Suite Software**



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# Higher Education Transition

## Examples



# Crossing Time Frame

FROM

**fix years** college education, front-loaded at the beginning of adulthood.



- 4 years during ages 18-22
- Formal learning in the classroom only
- Limited access to academic setting later in life
- Students prove ability by the age to be accepted
- Alumni returned to campus occasionally for selected events

TO

Students received a **lifetime** of learning opportunities.



- 6 years over a lifetime
- Knowledge obtained across classrooms and practical settings
- Seasoned adults returned to pivot careers and reconnect with community
- Students began studies at a range of ages
- Alumni returned as expert practitioners and enriched campus life

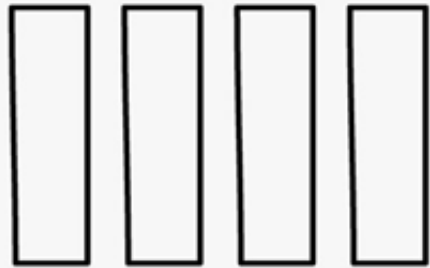
# “Open University”

Program	Requirements
For students currently employed <b>without a bachelor's</b> degree	<ul style="list-style-type: none"><li>• Flexible curriculum based on own needs.</li><li>• Complete the graduation requirements in <b>10 years</b>.</li></ul>
Targeting students in need of courses that meet the <b>demands of industry</b>	<ul style="list-style-type: none"><li>• Students take subject-specific courses at different schools, and apply to enter a school after earning a certain number of credits.</li><li>• Receive multidisciplinary bachelor's degree if students pass a credit review, earn <b>at least 48 credits</b> in their majors and pass an exam at the end of their studies.</li></ul>

# Crossing Learning Pace

## FROM

Structured, 4-year courses on a **quarterly rhythm**.



- 4 years: Freshman, Sophomore, Junior, Senior
- Lecture halls were the predominant teaching spaces
- 10-week courses were the standard

## TO

Three **phases of varied lengths** provided personalized, adaptive, calibrated learning.



- 6 years and 3 phases: Calibrate, Elevate, Activate
- New spaces were created for reflection and professor-student learning
- Calibration micro-courses

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# Full-Time Internship Program



- **Who:** Sophomore and above
- **Duration:** At least one semester
- **Credits:** Earned when matching requirements of the program

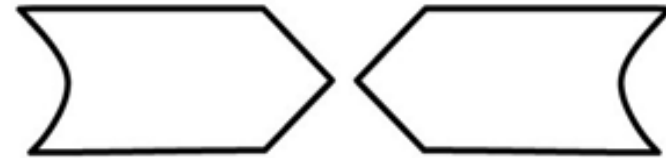
# Crossing Disciplines

FROM

TO

Knowledge within **a particular discipline** for graduation; skill development secondary.

**Skill development** became the foundation.



- Education organized around disciplinary topics
- University organized by departments based on academic disciplines
- Resumes and transcripts used to communicate for employers

- Skill acquisition now guaranteed fundamental
- Competency hubs, each with a dean, arranged around campus
- Skill-prints used to convey a broader story of capabilities and potential

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# Dual-Major

- Same credit number as single-major graduates

**23%** of students graduated with a dual-major degree.

## #1 in Taiwan

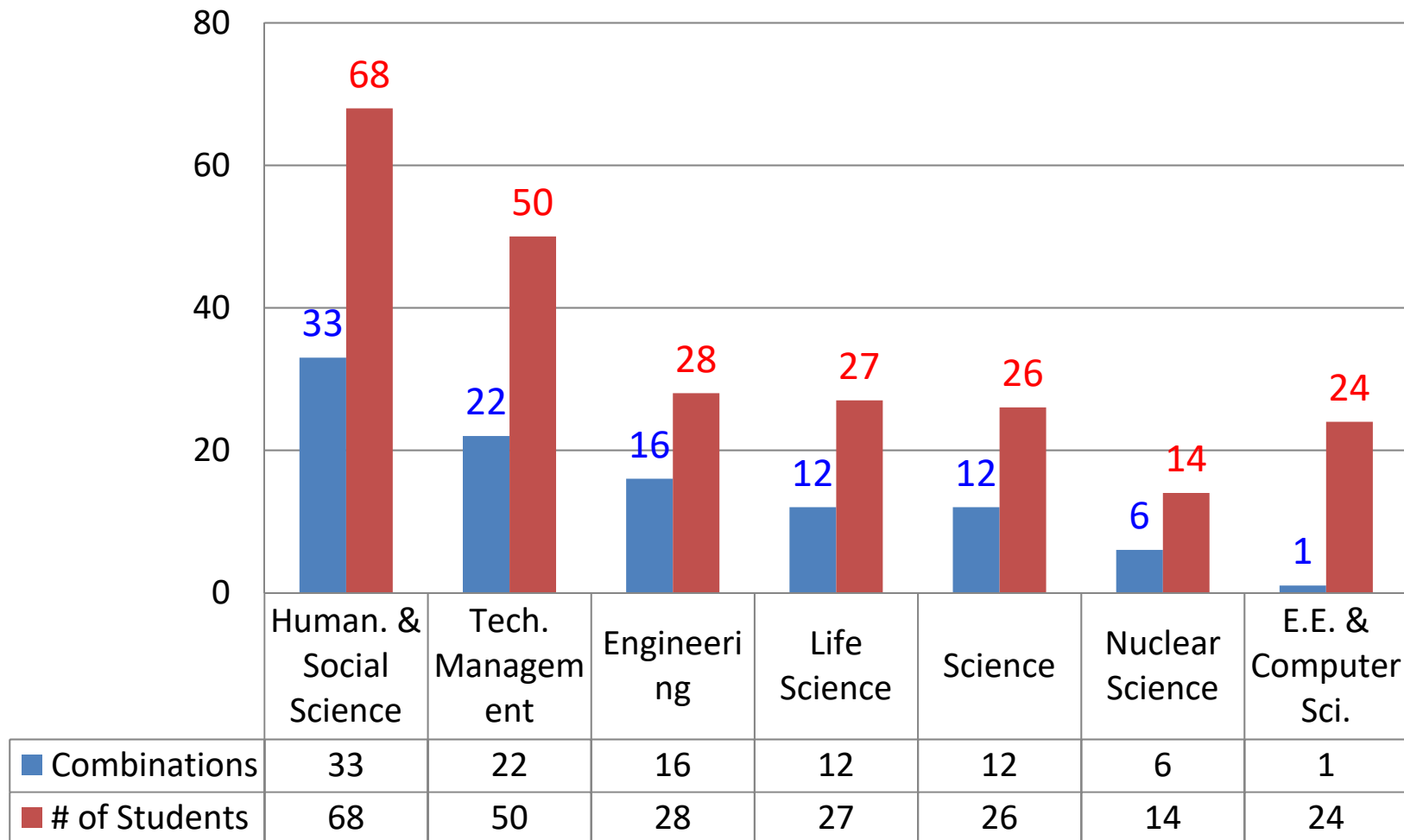
- College-radiated Interdisciplinary Programs
- 30+ credit hours offered via each discipline, mix-and-match interests and competencies

First Specialty	Second Specialty
Chinese (8)	Foreign Languages & Literature (3) 、 Economics (2) 、 Laws (1) 、 Psychology (1) 、 Music (1) 、 Power Mechanical Engineering (3)
Power Mechanical Engineering (5)	Philosophy (1) 、 Data Science (1) 、 Literature (1) 、 Foreign Languages and Literature (1) 、 Laws (1)
Economics (4)	Computer Science (1) 、 Quantitative Finance (1) 、 Laws (1) 、 Foreign Languages & Literature (1)
Material Science (2)	Electrical Engineering (1) 、 Chemical Engineering (1)
Foreign Languages (2)	Laws (1) 、 Literature (1)
Physics (2)	Nuclear Engineering and Energy (1) 、 Sociology (1)
Computer Science (2)	Quantitative Finance (1) 、 Chinese (1)
Energy & Environment (2)	Foreign Languages (1) 、 Arts & Design (1)
Life Science (1)	Laws (1)
Chemical Engineering (1)	Philosophy (1)
Education (1)	Chinese (1)



# Dual-Major Students from Each College

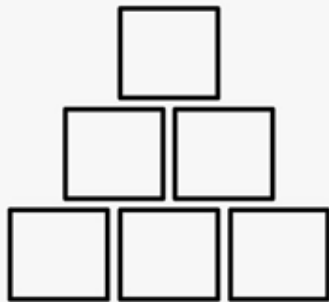
Total Students: 237



# Individualized (Purpose) Learning

## FROM

Students **declared Majors** and focused their studies around set requirements.



- Students often declared a major without clear reason
- Many alumni worked in fields unrelated to their majors
- Students deferred work on social issues until later in life

## TO

Students **declared Missions** and coupled their disciplinary pursuit with the purpose that fueled it.



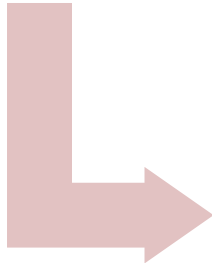
- Students pursued meaning and impact through studies and projects
- Alumni cited missions as the compass that guided their careers
- Global impact Labs extended platform for faculty research

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# Individualized Program

## Program Planning

- At the 2<sup>nd</sup> semester of freshman year, students submit an individualized program request.
- Program committee reviews the eligibility, course structure and degree title.



## Program Operation

- Students need to complete at least 128 credits to earn a bachelor's degree.



## Program Evaluation

- Program committee analyzes the results and ensures any recommendations or critical issues to improve the program for future years.

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# Individualized Program

1% of students on campus

- The Gleaners' Project –  
Early admission without unified test scores
- Individualized study programs customized based on individual's needs.

Examples of flexible curriculum

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# Individualized Program (Student 1)

## Gymnast

**Humanities**  
**17 Courses**

**Anthropology**  
**5 Courses**

**Physical Education**  
**10 Courses**

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# Individualized Program (Student 2)

**Physics**

**Physics  
(17  
Courses)**

**Life Science  
(11 Courses)**

**Electrical  
Engineering  
(5 Courses)**

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# Explore the Unexplored