

Global Engineering Education Exchange
at Delft University of Technology

Eliminate Lecturing by Flipped Learning

May 18, 2017

Tae-Eog Lee

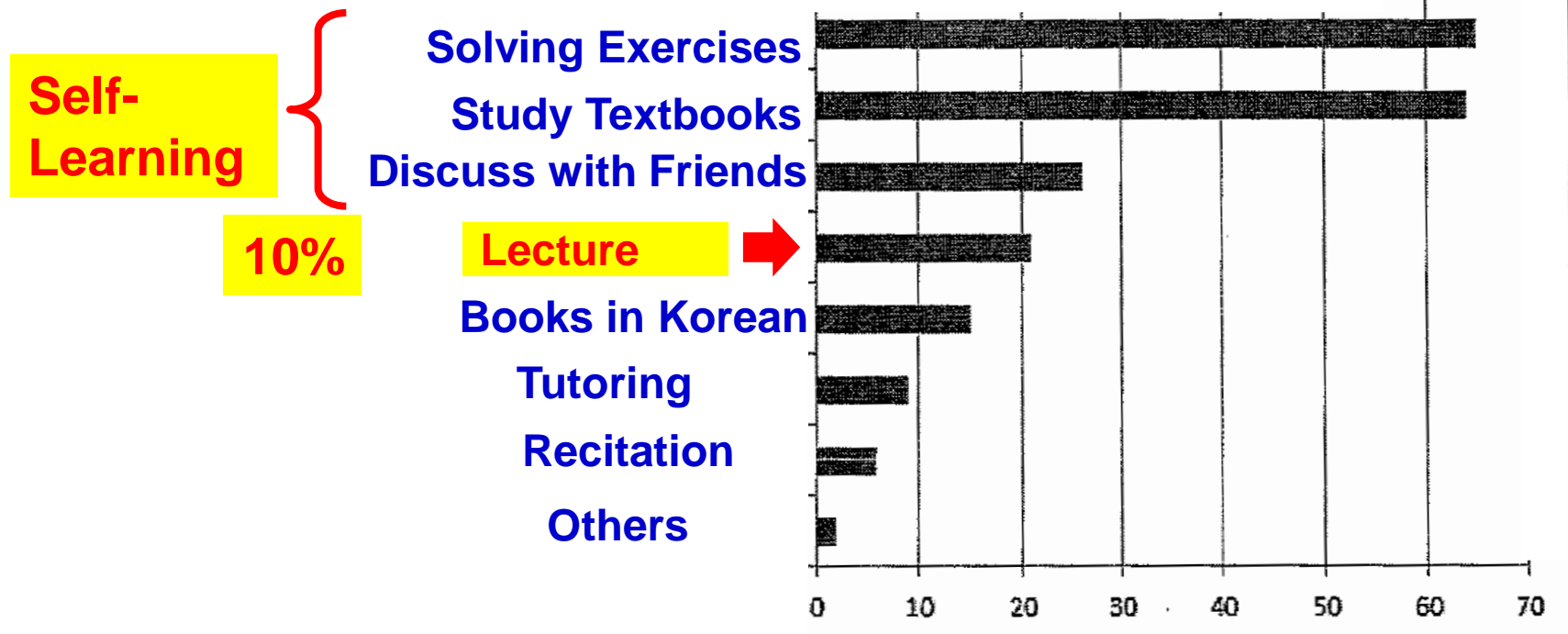
Head, Department of Industrial & Systems Engineering
(Former Director, Center for Excellence in Learning & Teaching)

KAIST

What was the most helpful for your study?

A survey for students in a “tutoring” class for a basic compulsory course (lecturing)

– Nov. 9, 2012, KAIST



Do we really need “**Lecturing**?”

McKinsey Report, 2012, “Education to Employment”, 2012

- **Conventional Lecturing & e-Learning are the worst.**
- **Need creativity, teamwork, communication, problem solving, hands-on skills, etc.**

“Lecture Fail” Project - Chronicles of Higher Education

- **Critical problems of conventional lecturing for one-way information transfer, PowerPoint Abuse**

Harvard Conference on Teaching & Learning, 2012

- **Failed mission** of understanding genuine meaning of the learned, making questions, deriving knowledge, and applying it and creating new ones in a new context

Move Over Harvard and MIT, Stanford Has The Real

“Revolution In Education” ([@ferenstein](#)) – **Lecturing, Worst, Wasting**

INTERACTION, PARTICIPATION

```
graph TD; A([INTERACTION, PARTICIPATION]) --> B([Creativity, Synthesis]); A --> C([Critical Thinking, Problem Definition/ Solving]); B --> D([Communication, Teamwork, Leadership]); C --> D; D --- E[Neuroscience, Brain Research, Cognitive Psychology]; E --- F([Concentration]); E --- G([Long-Term Memory]); E --- H([Structuring Knowledge]);
```

**Creativity,
Synthesis**

**Critical Thinking,
Problem Definition/
Solving**

**Communication,
Teamwork, Leadership**

Neuroscience, Brain Research, Cognitive Psychology

**Concentra
tion**

**Long-Term
Memory**

**Structuring
Knowledge**

Simple Effective Strategy

**Eliminate Lecturing
from Classrooms**

**Now, Enough
Class Hours for
Interaction/Participation**

Maximize Interaction/Participation in Class

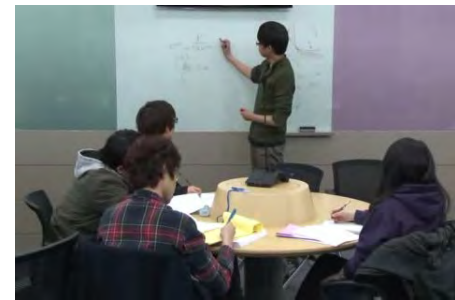
- Team-based Learning/Assignment/Problem Solving/
- Peer Tutoring, Labs, Cases, ...

Class Hours
1/2

- Review, Summary
- Quiz, Test
- Q&A

3~6 students/
Team

1 TA/
15 Students



Unique Creative Pedagogies

"Real" Deep Learning at Classroom

Focus on
1~3 **Key** Subjects

Focus on
Ways of **Thinking**

Closely **Relate** to
Lecture Video

Clear **Materials**

for Teamwork/
Assignment

Team Formation &
Management

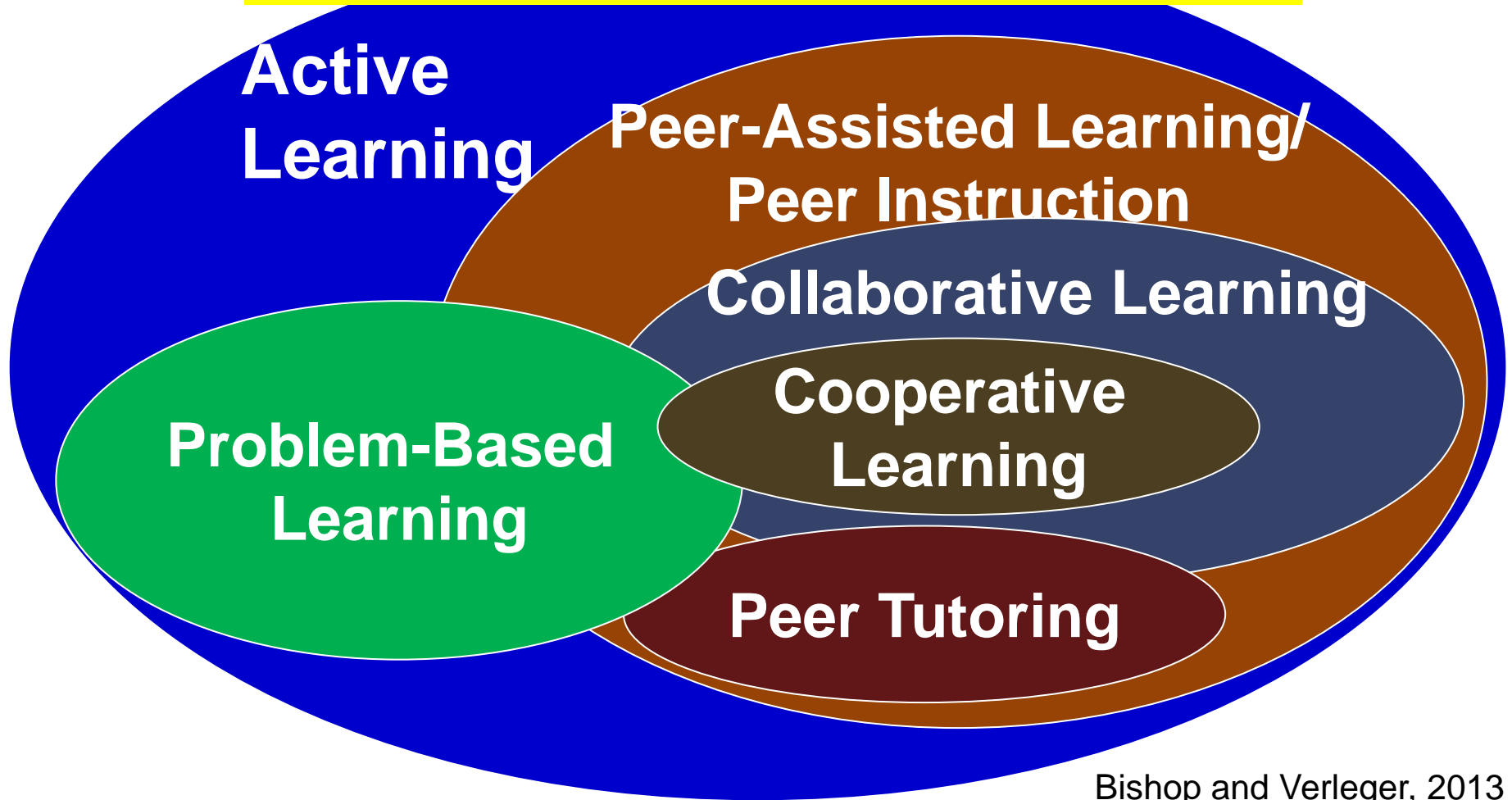
Step-by-Step
Guides/Tips

Round Tables,
Glass boards, ...

Team Discussion &
Individual Report

Student-Centric Learning at Classroom

Interaction/Participation



Bishop and Verleger, 2013

Prepare Basic Knowledge by e-Learning

10~20 Minutes
Modules

Audio Quality
>>
Video Quality

Review Questions

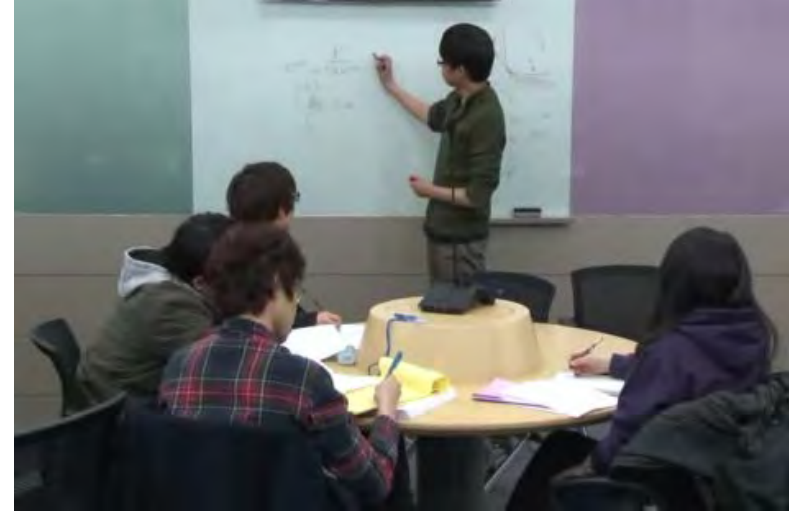
One-Page
Handwritten
Summary

Self-Recording,
Studio Recording

Recording
- **Easy** Access,
- Own pace

Case 1: Calculus I & II

- Lecture videos pre-study
- Extensive online exercises
 - Use Pearson's problem DB/contents



- Teamwork for Interactive problem solving and discussion in class
- TA roles in class
- High satisfaction
- 10 points higher for a part of mid term exam than conventional lecturing classes

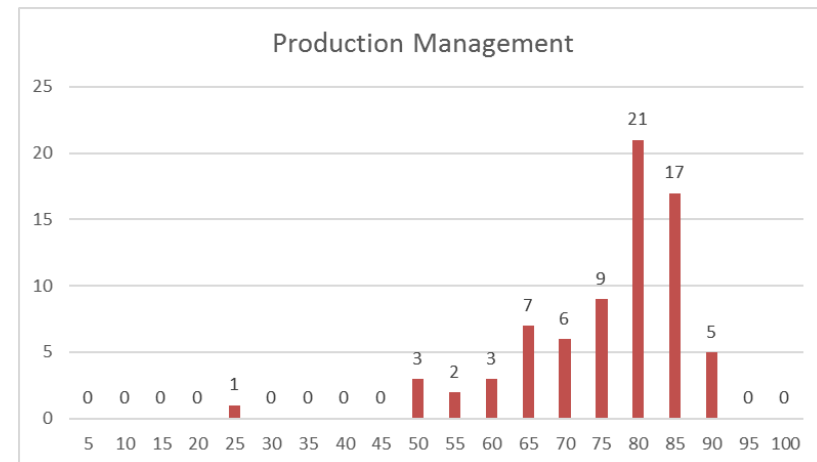
CASE 2: Introduction to Programming

- **Programming assignments** in class for a group (2 or more)
- **self-study** of lecture videos before class
- Culture of participation and interaction
- Class activities should be **closely associated with lecture videos.**
- **Team management** is important. – no free riding!
 - Grouping, Periodic regrouping, **Peer Reviews**
- Should **motivate** students to participate
- Exam scores: **1st and 3rd** among 12 parallel classes



Case 3: Production Management

- 87 Students
- 4 TAs
- Team Assignments/Labs/Cases → Do & Think
- Step-by-Step Class Materials → Reduce Time
- Closely Related to Lecture Videos
- Lecture Video & Narrations
- Review Questions
- Highly Positively Skewed




Education 3.0 Class

**Interaction/
Student Participation**
In Class

**e-Learning
(Lecturing)**
Outside Classrooms

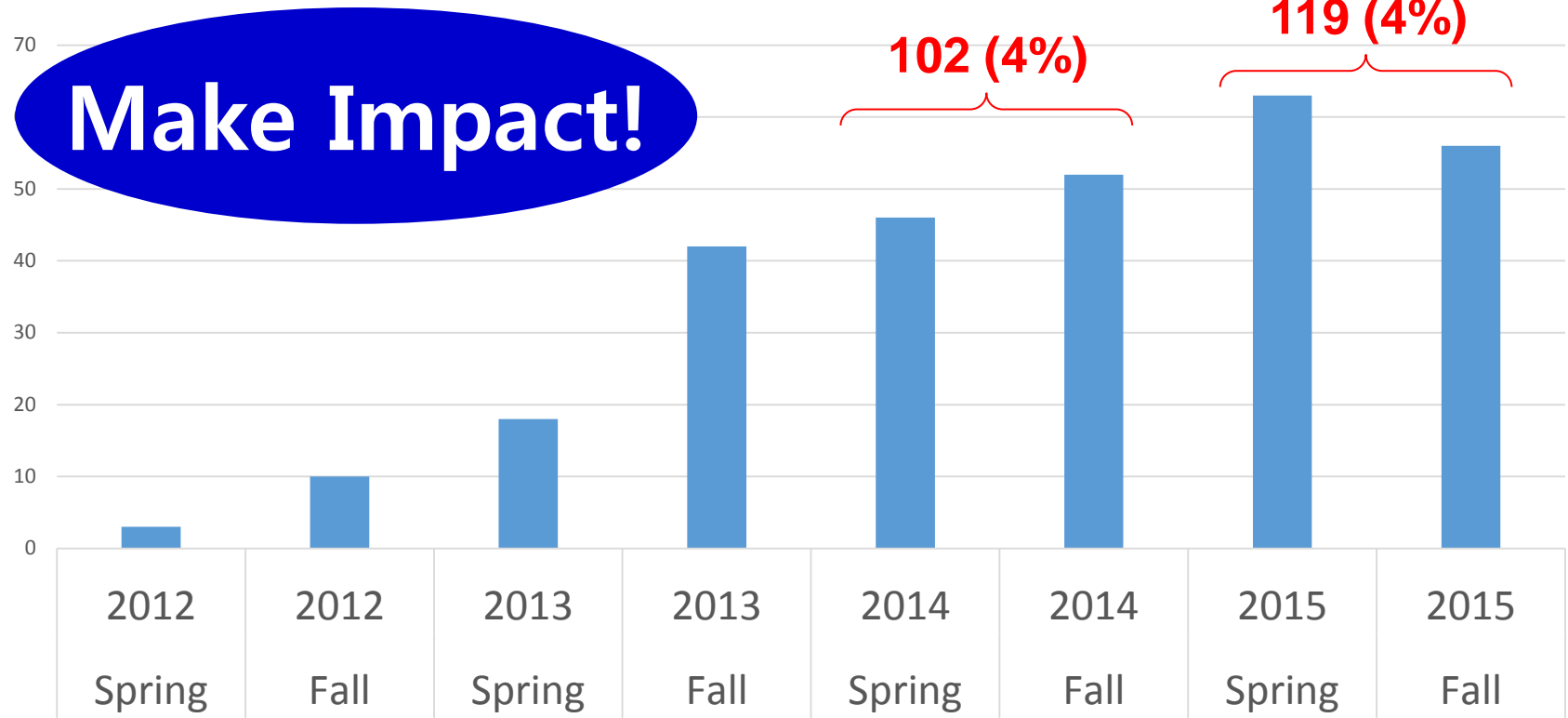
“a” Flipped Learning

**But, more emphasis on
interaction, participation,
teamwork, self-learning, ...**



Feedback

Number of Education 3.0 Classes



- **All disciplines, Undergraduate & Graduate**
- **Voluntary Applications from Professors**
- **Small Incentives**

Goal
30%(800/yr)

Satisfaction 4.0/5.0

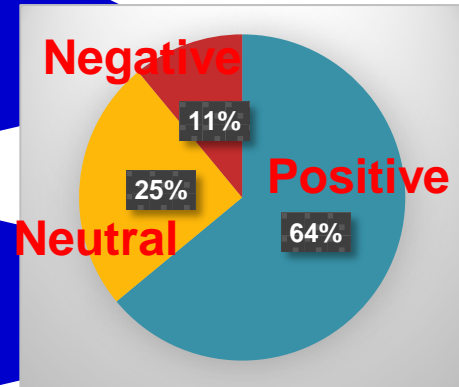
Class Evaluation 4.2/5.0

University Average = 4.1

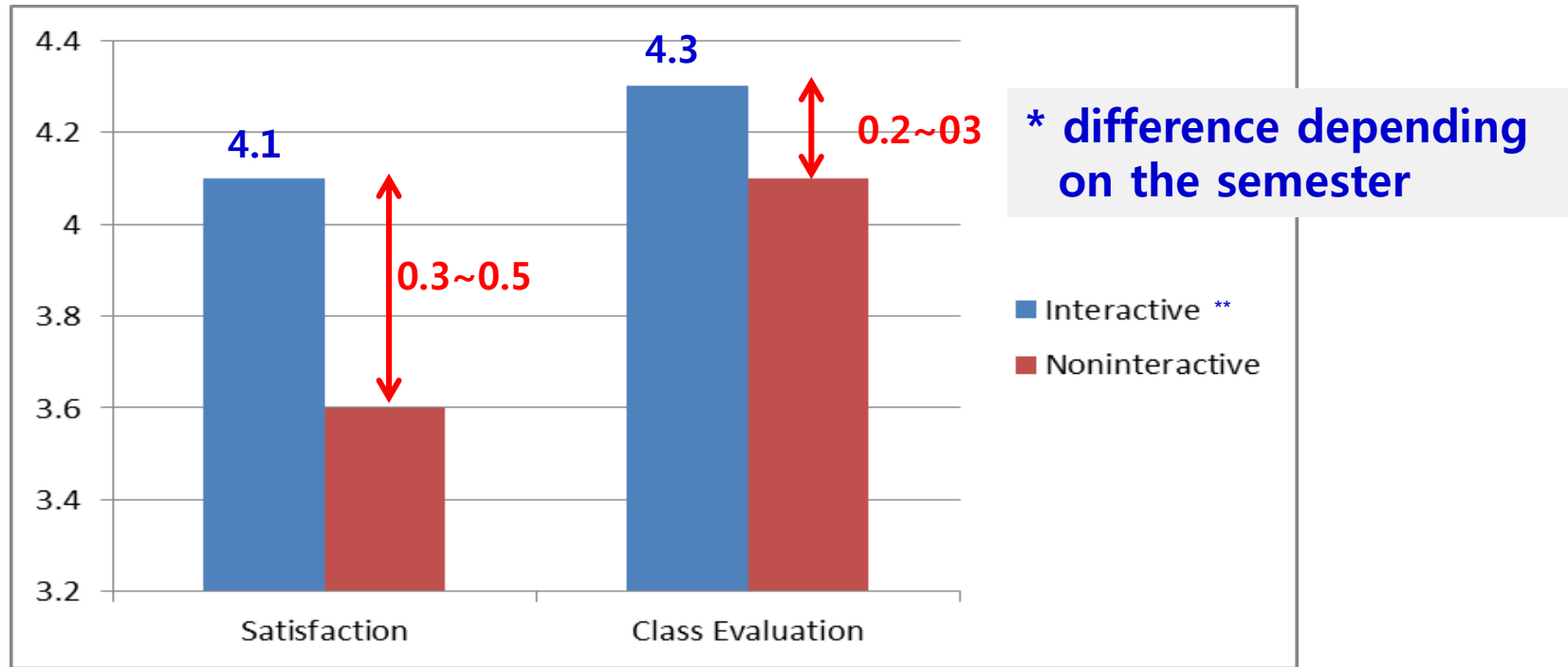
Prefer to Lecturing 62%

Retention 69%

Learning Habit Change 71%



Much Better when Highly Interactive



Interactive: Top 30% Classes of High Interaction
Non-interactive: Bottom 30% Classes of Low Interaction

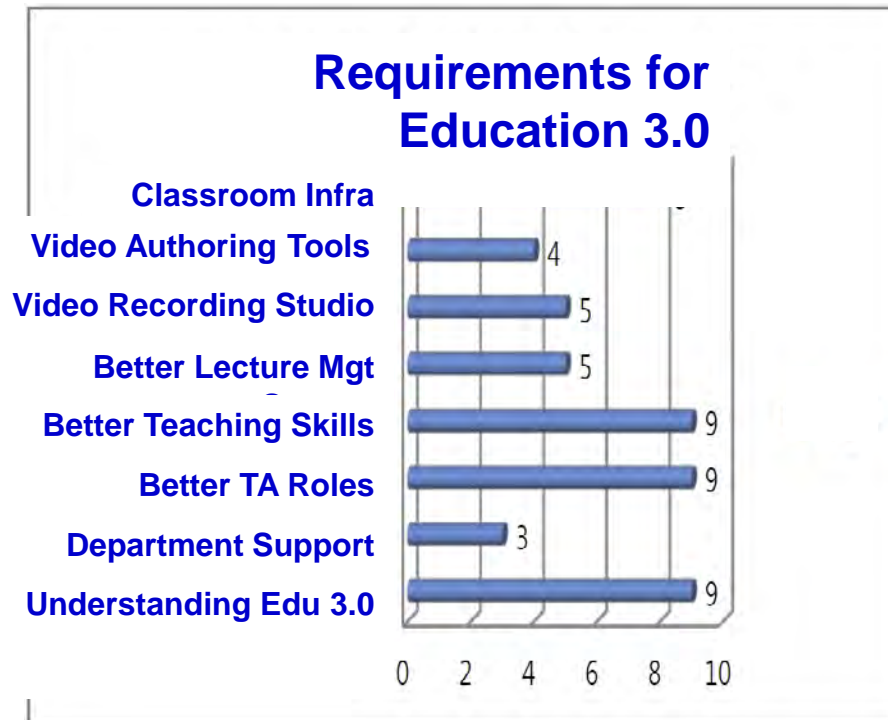
Interactive classes have significantly higher satisfaction and evaluation

Professor Feedback

**Better
Understanding:
75~88%***

**Retention:
87~98%***

* Depends on the semester



Sustainable!

Even Better!

Just Begun!



Nature,
vol. 514 No. 7522, Oct. 16, 2014

**The Flipped
University:
KAIST Education 3.0**

Forbes

Forbes

Google Classroom Offers Assignment Center for Students and Teachers [Action on Twitter](#)

Search companies, people and lists

KAIST Doesn't Wait For Change In Korea, Pioneers 'Education 3.0'

3/17/2014 @ 9:50:22 - 1,295 views

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As South Korea struggles to escape the downsides of centuries of a Confucian emphasis on rote learning while retaining the positives from that Confucian legacy, at least a couple institutions in the country aren't waiting for permission to move forward.

KAIST, the Korean Advanced Institute of Science and Technology, a top public research university located 150 km south of Seoul in the city of Daejeon, is trying not only to spark innovation in research and the creation of new products, services, and companies, but also in how it educates.

In my meetings with several on the campus—including the president of KAIST, [Steve Kang](#); Tae-Eog Lee, a professor and the director of the [Center for Excellence in Learning and Teaching](#) at KAIST; and Woontack Woo, a professor in the KAIST [Graduate School of Culture Technology](#) with a specialty in [ubiquitous virtual reality](#), I heard about a range of initiatives designed to bring KAIST to the forefront of innovation in a variety of fields, including the move beyond mass education to mass-customized education through blended learning, or what KAIST calls Education 3.0.


Michael Horn
Contributor

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I write about transforming education through digital learning
[full bio](#)

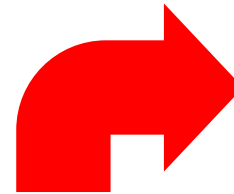
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Roadmap to Creative Teaching/Learning

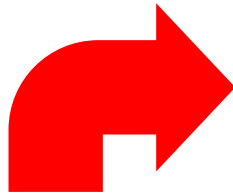
Send Lecturing
from Classroom
to Online **"Text"book**



**Creative
Teaching/
Learning**

Fully Interactive/
Participative Class

e-Learning →
a Part of Learning Contents



**Flipped
Learning**

Interactive/Participative Class +
e-Learning

**Conventional
Lecturing**

One-Way Information Transfer

e-Lecturing

Eliminate
Lecturing

Can do much better,
much more

Can make students
"THINK" and "TALK"

Q&A

