Advanced Active Learning for Faculty of Engineering, RMUTT

Natha Kuptasthien, PhD
Rajamangala University of Technology Thailand (RMUTT), Thailand
CDIO Collaborator/Leader/Master Trainer/Council member-at-large
Finnish University Pedagogy, Mentor
RMUTT, Smart Teacher Training Academy

แนะนำทีมวิทยากร

ณฐา

รุ่งนภา

เอมอร

ธีรวัฒน์

Custom-made Training Program : Workshop

Day 1
STEEP Analysis
Graduate Attributes
Student-center Approach
Constructive Alignment
Exercise: ILO

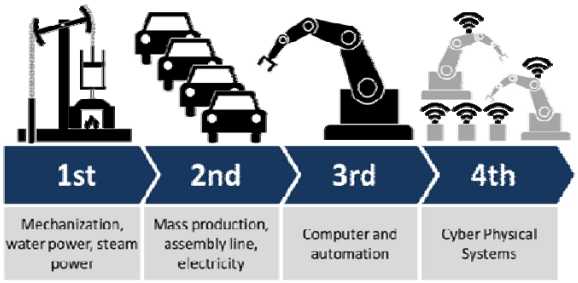
→

Day 2
Innovating Teaching and Learning approaches

Design Appropriate Assessment

→

Day 3
Team Presentation
Teaching Simulation
Peer Comment
Comment from Trainers



New Competency

in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

ทำไมต้องปรับเปลี่ยนการเรียนการสอน ?

And Rise of MOOC platforms

udemy
KHAN ACADEMY
coursera
UDACITY
edX
NPTEL
MIT OCW
myopencourses

Source: https://www.chatterboxpromotions.com/blog/cell-phones-and-websites

How about our classrooms?

We are teaching 21st century students with 20th century curricula in 18th century classroom

Inauguration of Smart Teacher Training Academy 5th June 2018

Science-Technology-Engineering-Mathematics Integration

STEM Ambassadors

FINLAND UNIVERSITY

Academic Mentors

Pedagogical Competency
Teaching-Learning Design

Learning Space Design

Learning Space Designer

RMUTT

STTA Smart Teacher Training Academy

LeX Facilitators

Design Thinking

Hands-on Professional Practice

Vocational Meister

cdio

Master Trainers

Competency-based / Outcome-based Curriculum Design
Learning Experience Design

Project with Finland

2014
MOU Signing

2015-2016
University Pedagogy

2016-2017
University Pedagogy

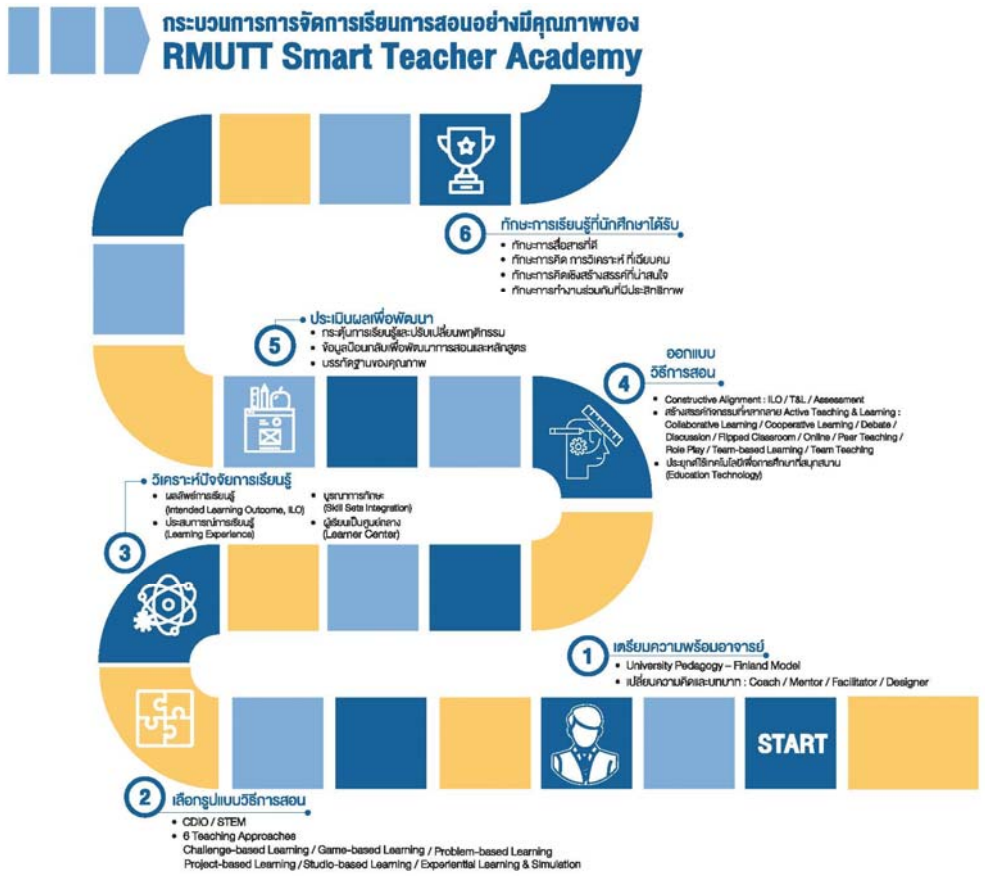
2017-2018
University Pedagogy

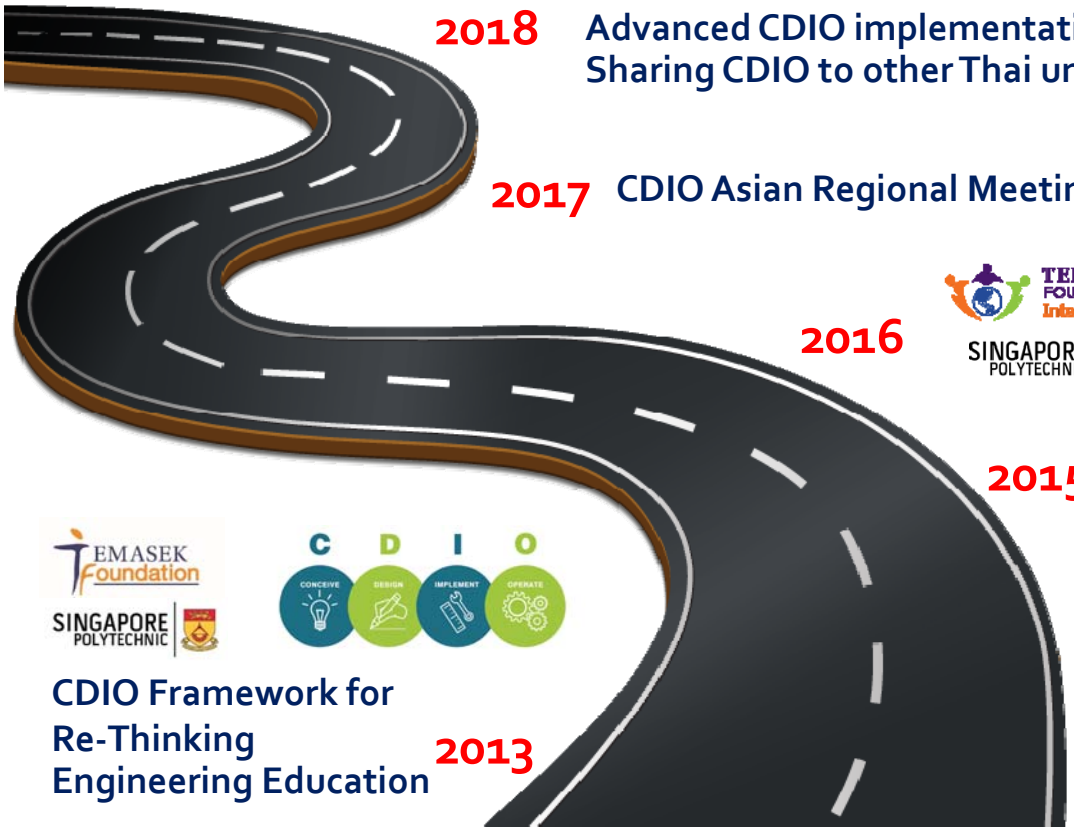
Shift Mindsets:

Teacher
Controller
Dictator

Teacher Role

Designer
Facilitator
Mentor
Coach





2018 Advanced CDIO implementation at 9 RMUTs
Sharing CDIO to other Thai universities e.g. SUT

2017 CDIO Asian Regional Meeting

2016

TEMASEK FOUNDATION International
SINGAPORE POLYTECHNIC

Advanced CDIO
9 RMUTs

2015 CU 2nd Thai Collaborator
Promote CDIO:
Workshop, seminar, talks,
tutorial, conference

TEMASEK Foundation
SINGAPORE POLYTECHNIC

C D I O
CONCEIVE DESIGN IMPLEMENT OPERATE

CDIO Framework for
Re-Thinking
Engineering Education

2013

2014

RMUTT 1st Thai Collaborator
CDIO Thailand Founded

2013 Asian Regional Conference at SP

2013 | 2014

CDIO Workshop Introduction 100 persons

Full CDIO I Workshop 10 faculty members

2013 Asian Regional Conference at SP

2014 Asian Regional Conference at KIT

TF & SP Visit Project Closing

RMUTT 1st Thai Collaborator - CDIO Worldwide Initiatives Presenting at 2014 CDIO Asian Regional Meeting

2013 | 2014

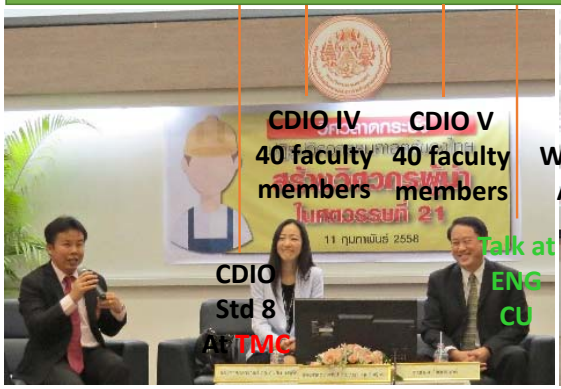
Cascade Training

CDIO Std 2-3 at MCT

CDIO II Workshop 30 faculty members

CDIO III Std 7-8 30 faculty members

2015



2016 Conference at Turku Finland

2016

CDIO VI
60 faculty members

13 – 15 March 2017 Asian Regional Conference at RMUTT & Chula

2017

CDIO (Advanced) 9 RMUTs

CDIO (Advanced) Master Trainers

CDIO (Advanced) Cascade Training

2018 CDIO Meeting, Danang, Vietnam

Active Learning, BA, RMUTL

2018

CDIO Workshop, Mass Com, CMU

Design Thinking, Central Group

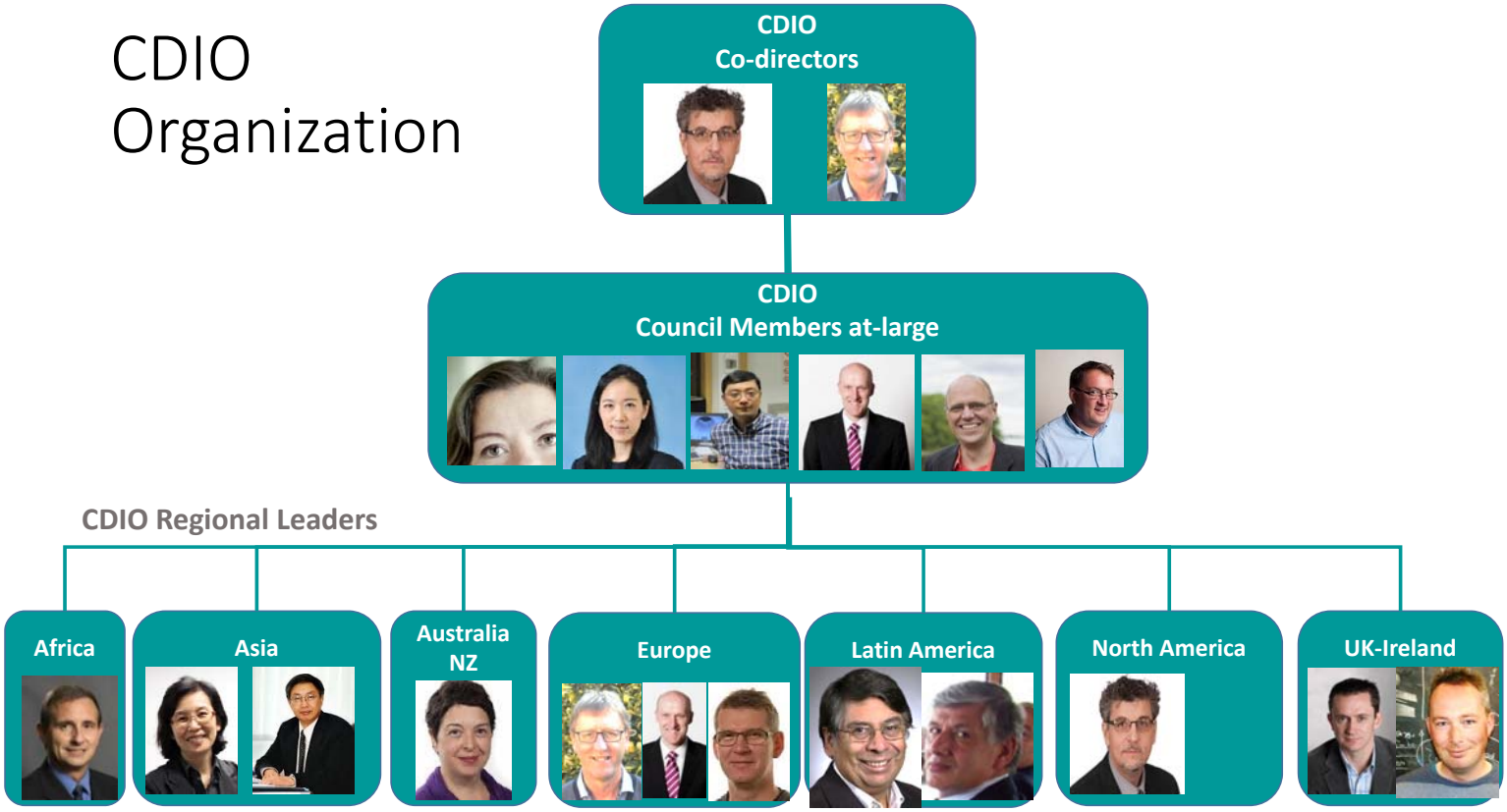



Conceive – Design — Implement — Operate

Engineering graduates should be able to: Conceive – Design — Implement — Operate complex value-added engineering systems in a modern team-based engineering environment to create systems and products.

http://www.cdio.org/

CDIO Organization



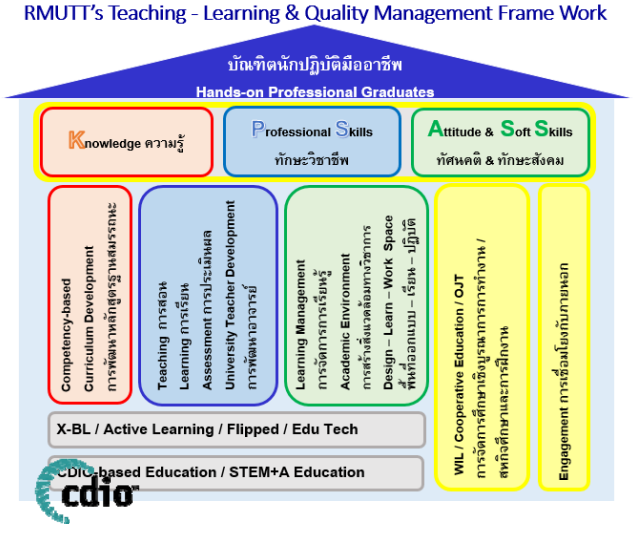
Course Level

Program Level

1. Industrial Engineering
2. Business Computer
3. Architecture Technology
4. Digital Media
5. TV & Radio
6. Photo & Cinematography
7. Printing Technology
8. Multimedia
9. Advertisement & PR
10. Hotel Management
11. Innovative Product for Aesthetics

Institutional Level

RMUTT's Teaching - Learning & Quality Management Frame Work

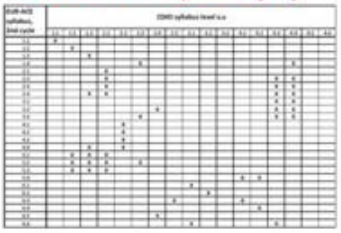


Validation Against National Accreditation Frameworks

ABET EC 2010 (USA)

CEAB (CANADA)

EUR-ACE (Europe)



TABEE (Thailand)

ABET Criteria 3	a	e	c	b	k	d	g	h	f	j	i
TABEE Criteria 3	1	2	3	4	5	6	7	8	9	10	11
CDIO Syllabus											
1.1. Knowledge of Underlying Sciences	●										
1.2. Core Engineering Fundamental Knowledge	●										
1.3. Advanced Engineering Fundamental Knowledge, Methods and Tools	❍				●						
2.1. Analytical Reasoning & Problem Solving		●			❍						
2.2. Experimentation, Investigation & Knowledge Discovery				●							
2.3 System Thinking			❍								
2.4. Attitudes, Thought and Learning											●
2.5. Ethics, Equity and Other Responsibility									●		
3.1. Teamwork						●					
3.2. Communications							●				
3.3. Communication In Foreign languages											
4.1. External, Societal and Environmental Context			●					●		●	
4.2. Enterprise and Business Context			●					●		●	
4.3. Conceiving, Systems Engineering and Management			●								
4.4. Designing			●								
4.5. Implementing			❍								
4.6. Operating			❍								
4.7 Leading Engineering Endeavor											
4.8 Entrepreneurship											

● Strong Correlation ❍ Good Correlation

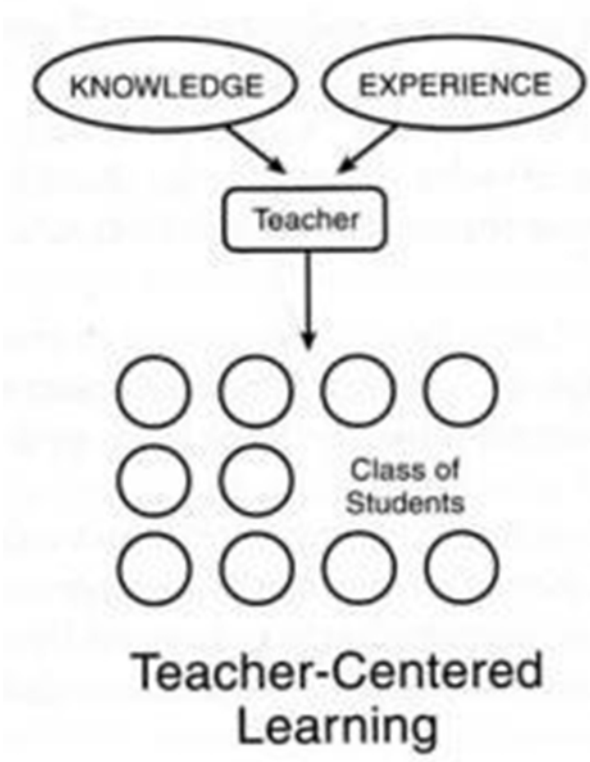
Year 1 | Year 2 | Year 3 | Year 4

Basic Engineering → IE Design & Build → Machine Design & SIM → Co-Op OJT → Plant Design

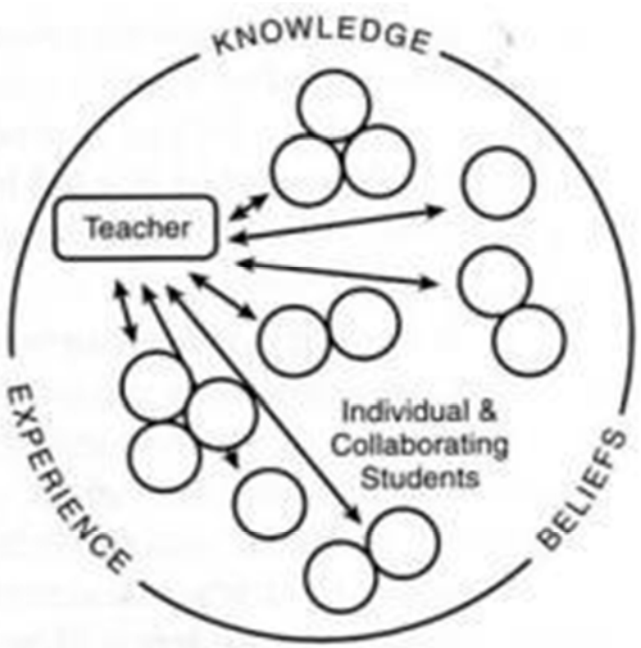
Engineering Workshop → IE Mini Project → IE Pre-Project → IE Project

Student 4-year Experiences for Industrial Engineering

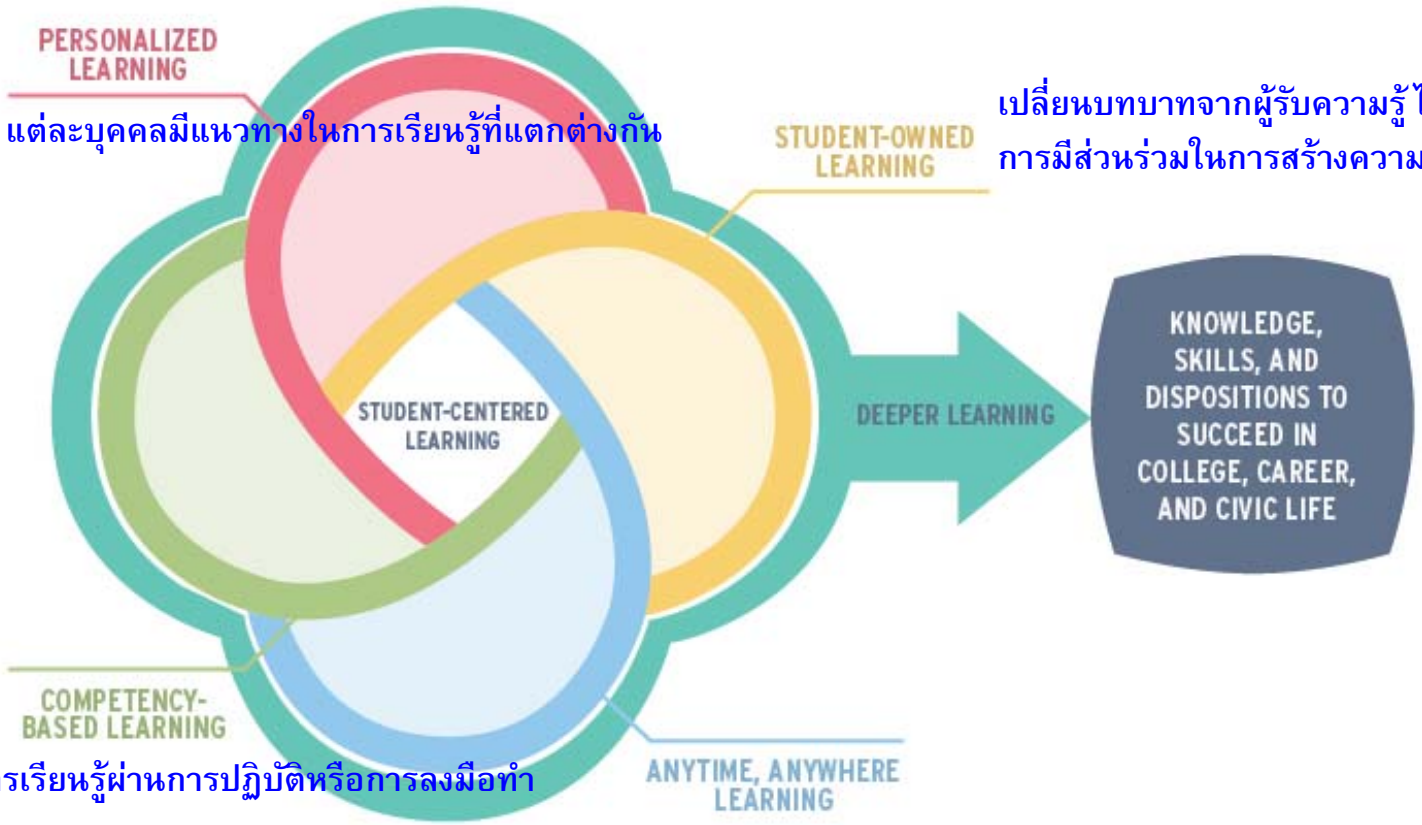
Play – Passion - Purpose



Teacher-Centered Learning

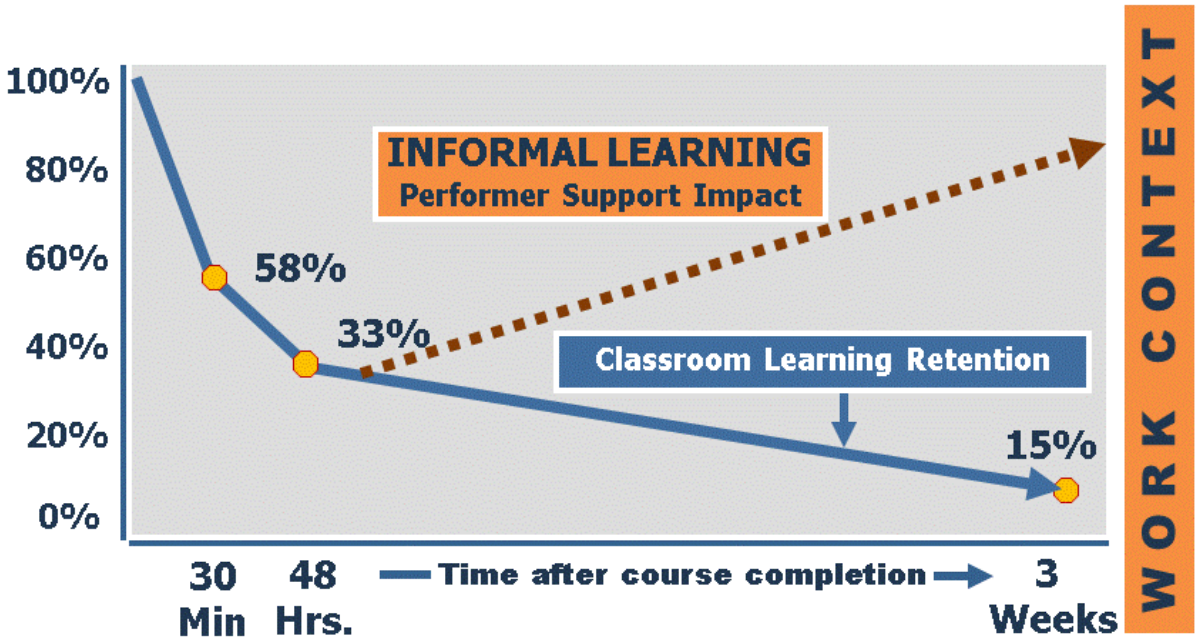


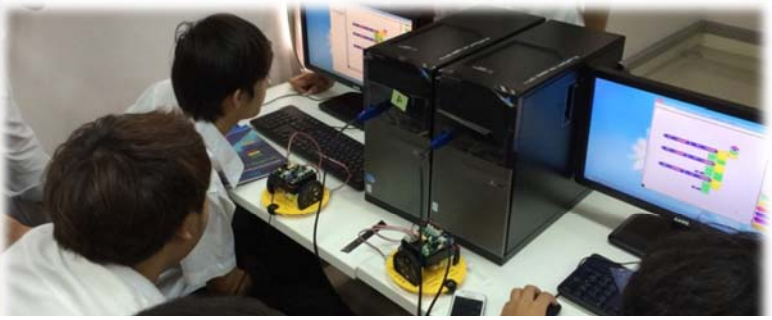
Student-Centered Learning


PERSONALIZED LEARNING
แต่ละบุคคลมีแนวทางในการเรียนรู้ที่แตกต่างกัน
STUDENT-OWNED LEARNING
เปลี่ยนบทบาทจากผู้รับความรู้ไปสู่การมีส่วนร่วมในการสร้างความรู้
STUDENT-CENTERED LEARNING
DEEPER LEARNING
KNOWLEDGE, SKILLS, AND DISPOSITIONS TO SUCCEED IN COLLEGE, CAREER, AND CIVIC LIFE
COMPETENCY-BASED LEARNING
การเรียนรู้ผ่านการปฏิบัติหรือการลงมือทำ
ANYTIME, ANYWHERE LEARNING


I see and I forget.
I hear and I remember.
I do and I understand.
— Confucius
After 2 weeks, we tend to remember ...
Reading
Hearing Words
Seeing
Watching a Movie
Looking at an Exhibit
Watching a Demonstration
Seeing It Done on Location
Participating in a Discussion
Giving a Talk
Doing a Dramatic Presentation
Simulating the Real Experience
Doing the Real Thing
• 10% of what we READ
• 20% of what we HEAR
• 30% of what we SEE
• 50% of what we SEE & HEAR
• 70% of what we SAY
• 90% of what we SAY & DO
Passive
Active
Source: Edgar Dale (1969)

กระบวนการเรียนรู้ Active Learning ทำให้ผู้เรียนสามารถรักษาผลการเรียนรู้ให้อยู่คงทนได้มากและนานกว่ากระบวนการเรียนรู้ Passive Learning



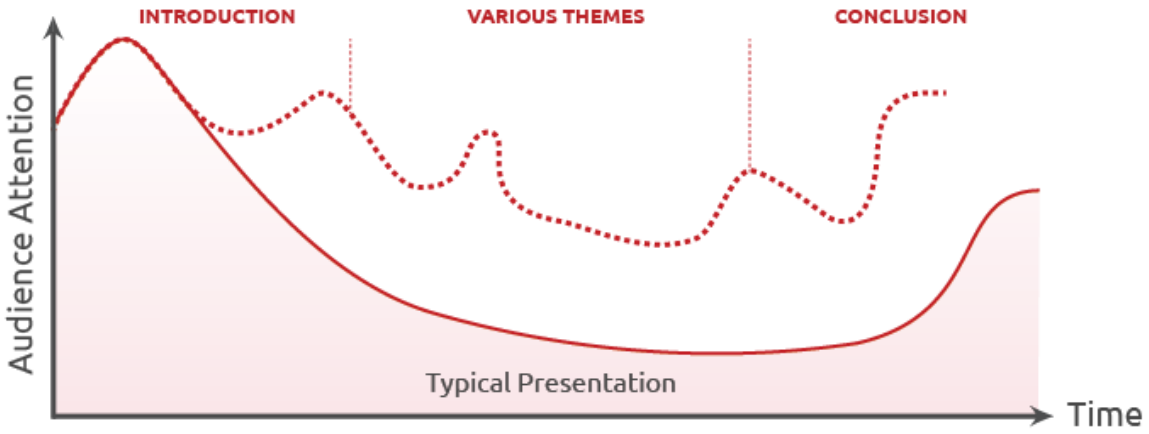


จัดกิจกรรมให้ผู้เรียนได้การเรียนรู้โดยการอ่าน เขียน โต้ตอบ วิเคราะห์ปัญหา ได้ใช้กระบวนการคิดขั้นสูง วิเคราะห์ สังเคราะห์ ประเมินค่า

Structure Lecture

Lecture has small activities
Involve students' learning

Time on task
Instant feedback



One-minute paper

Reflect on learning

- What is the most important thing you learn today?

Clearing the muddiest point

- What are you still struggling to understand lecture today?

Help the student improve

- How will you do better next time?

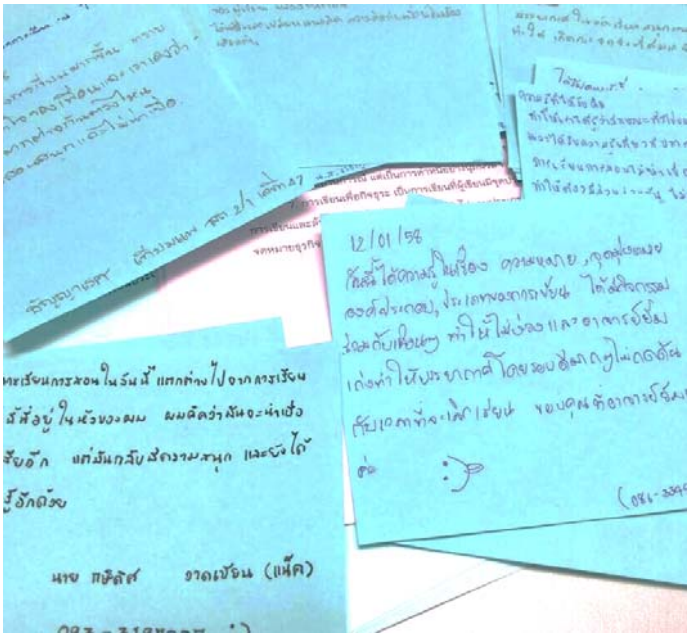
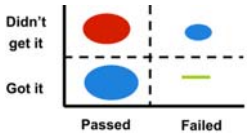


Photo credits: Aj. Parichat Payoongsri

Cooperative Learning



Involve small teams
Different levels of ability

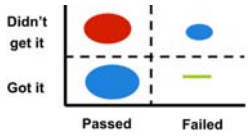
Use several learning activities to improve their understanding

Each member is responsible for his/her own learning and help team members learn

Create atmosphere of achievement

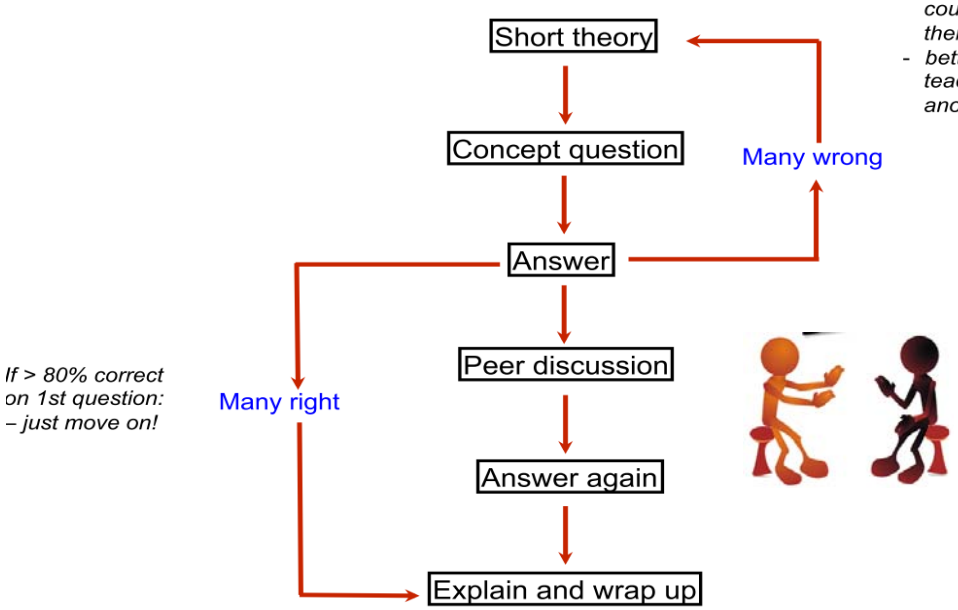
Change the way we teach and organize classroom

Concept Question



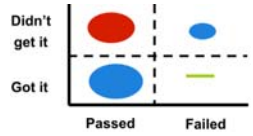
If < 20% correct on 1st question:
- *only a few who could explain to their peers*
- *better if the teacher gives it another go*

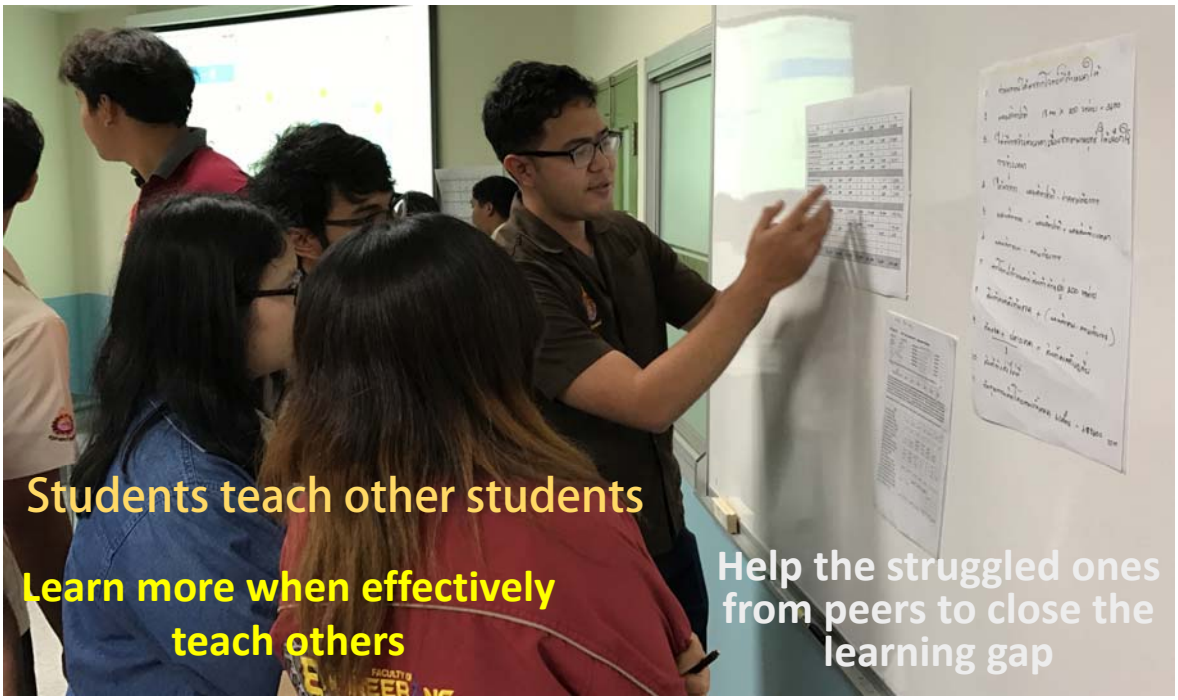
Flow chart:



If > 80% correct on 1st question: – just move on!

Peer Instruction





Flipped Classroom with Cooperative Learning

List of most common errors

- The purpose **is not** that *this particular* report should be perfect
- The purpose **is** that the **student should develop the skills** to write reports (so that he/she may write 1000 reports later)

Peer Assessment to provide Instant Feedback

Month	t	At	t^2	tAt	
Jan	1	19	1	19	0.454545455
Feb	2	23	4	46	15.37878788
Mar	3	15	9	45	
Apr	4	12	16	48	
May	5	15	25	75	
Jun	6	15	36	90	
Jul	7	15	49	105	
Aug	8	19	64	152	
Sep	9	22	81	198	
Oct	10	21	100	210	
Nov	11	21	121	231	
Dec	12	23	144	276	
	78	220	650	1495	
	0.5 point	0.5 point	0.5 point	0.5 point	

$$b = \frac{(12 \times 1495) - (78 \times 220)}{(12 \times 650) - 78^2}$$

$$= \frac{17940 - 17160}{7800 - 6084}$$

$$b = \frac{n\sum tA_t - \sum t \sum A_t}{n\sum t^2 - (\sum t)^2} = \frac{780}{1716} = 0.4545 \approx 0.5$$

2 points

$$a = \frac{\sum A_t}{n} - \frac{b\sum t}{n}$$

$$a = \frac{\sum A_t - b\sum t}{n} = \frac{220 - (0.5 \times 78)}{12}$$

$$= \frac{220 - 39}{12} = \frac{181}{12} = 15.08 \approx 15.1$$

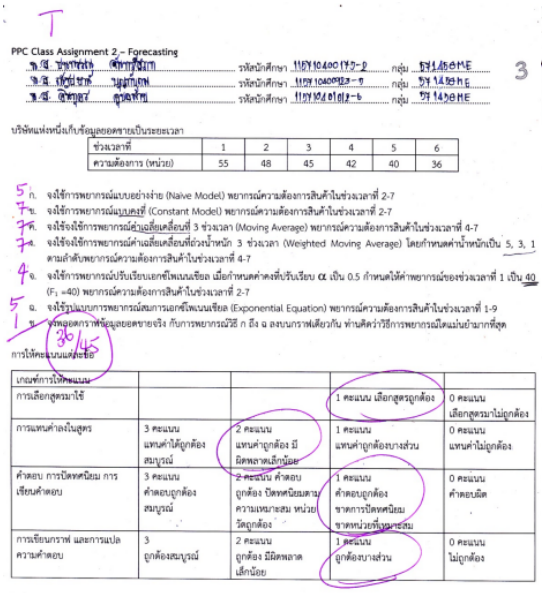
2 points

สรุป Ft = a+bt

สมการในการพยากรณ์ได้แก่ Ft = 15.1 + 0.5t — 2 points

พยากรณ์สำหรับ t = 13

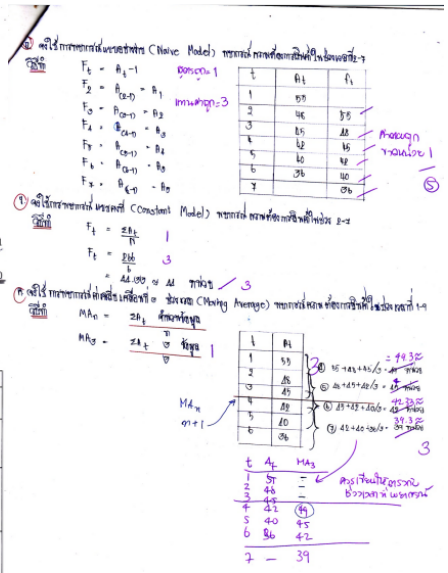
Ft = 15.1 + 0.5(13) =	21.6	ปรับเป็น	22	หน่วย
	1 points		1 points	



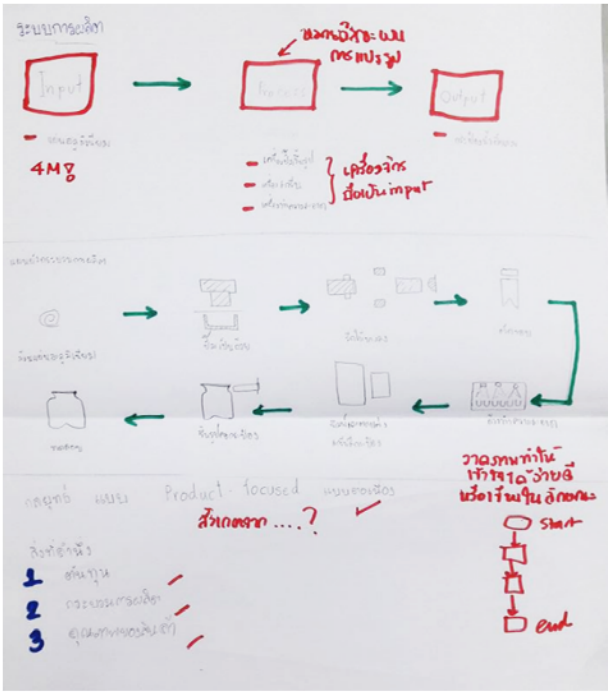
PPC Class Assignment 2 – Forecasting

ช่วงเวลาที่	1	2	3	4	5	6
ความต้องการ (หน่วย)	55	48	45	42	40	36

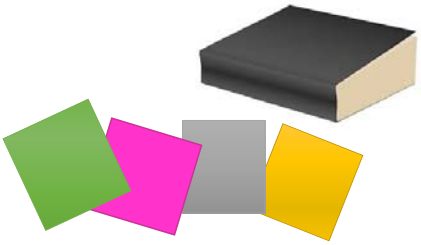
เกณฑ์การให้คะแนน				
การเลือกสูตรมาใช้			1 คะแนน เลือกสูตรถูกต้อง	0 คะแนน เลือกสูตรมาไม่ถูกต้อง
การแทนค่าลงในสูตร	3 คะแนน แทนค่าได้ถูกต้องสมบูรณ์	2 คะแนน แทนค่าถูกต้อง มีผิดพลาดเล็กน้อย	1 คะแนน แทนค่าถูกต้องบางส่วน	0 คะแนน แทนค่าไม่ถูกต้อง
คำตอบ การปัดทศนิยม การเรียนคำตอบ	3 คะแนน คำตอบถูกต้องสมบูรณ์	2 คะแนน คำตอบถูกต้อง ปัดทศนิยมตามความหมายสม หน่วยถูกต้อง	1 คะแนน คำตอบถูกต้อง ขาดการปัดทศนิยมขาดหน่วยที่เหมาะสม	0 คะแนน คำตอบผิด
การเขียนกราฟ และการแปลความคำตอบ	3 ถูกต้องสมบูรณ์	2 คะแนน ถูกต้อง มีผิดพลาดเล็กน้อย	1 คะแนน ถูกต้องบางส่วน	0 คะแนน ไม่ถูกต้อง



Knowledge as a Context



Jigsaw Classroom



...not only teach **what** they want their students to learn, but **how** to learn it...

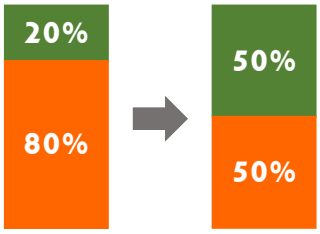
Redesign learning activities

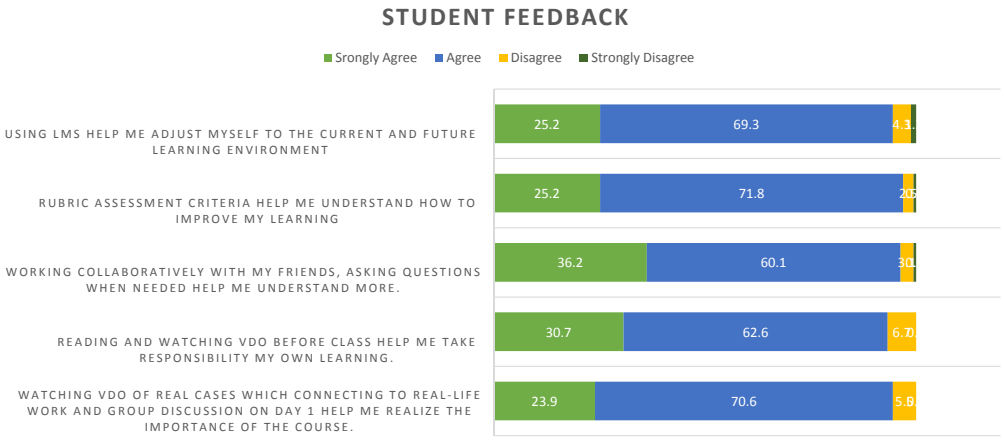
Photo credits: Aj. Nachirat Rachburi

Assessment : Use various methods of assessment

Formative Assessment
Self-assessment
Peer-assessment
Teacher Feedback

Summative Assessment





Fab Lab

Innovating Workspace

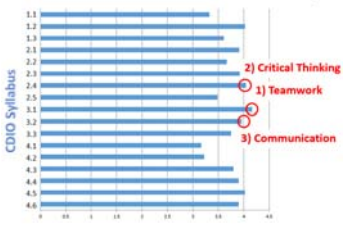
บทบาทของครู กับ Active Learning

- กิจกรรมต้องสะท้อนความต้องการในการพัฒนาผู้เรียน
- เน้นการนำไปใช้ประโยชน์ในชีวิตจริงของผู้เรียน
- สร้างบรรยากาศของการมีส่วนร่วม และการเจรจาโต้ตอบที่ส่งเสริมให้ผู้เรียนมีปฏิสัมพันธ์ที่ดีกับผู้สอนและเพื่อนในชั้นเรียน
- กระตุ้นให้ผู้เรียนประสบความสำเร็จในการเรียนรู้

บทบาทของครู กับ Active Learning

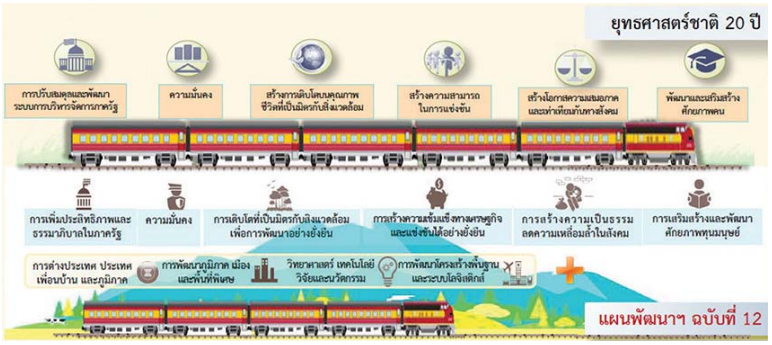
- จัดสภาพการเรียนรู้แบบร่วมมือ ส่งเสริมให้เกิดการร่วมมือในกลุ่มผู้เรียน
- ให้โอกาสผู้เรียนได้รับวิธีการสอนที่หลากหลาย
- วางแผนเกี่ยวกับเวลาในจัดการเรียนการสอนอย่างชัดเจน ทั้งในส่วนของเนื้อหา และกิจกรรม
- ยอมรับในการแสดงออกความคิดของผู้เรียน

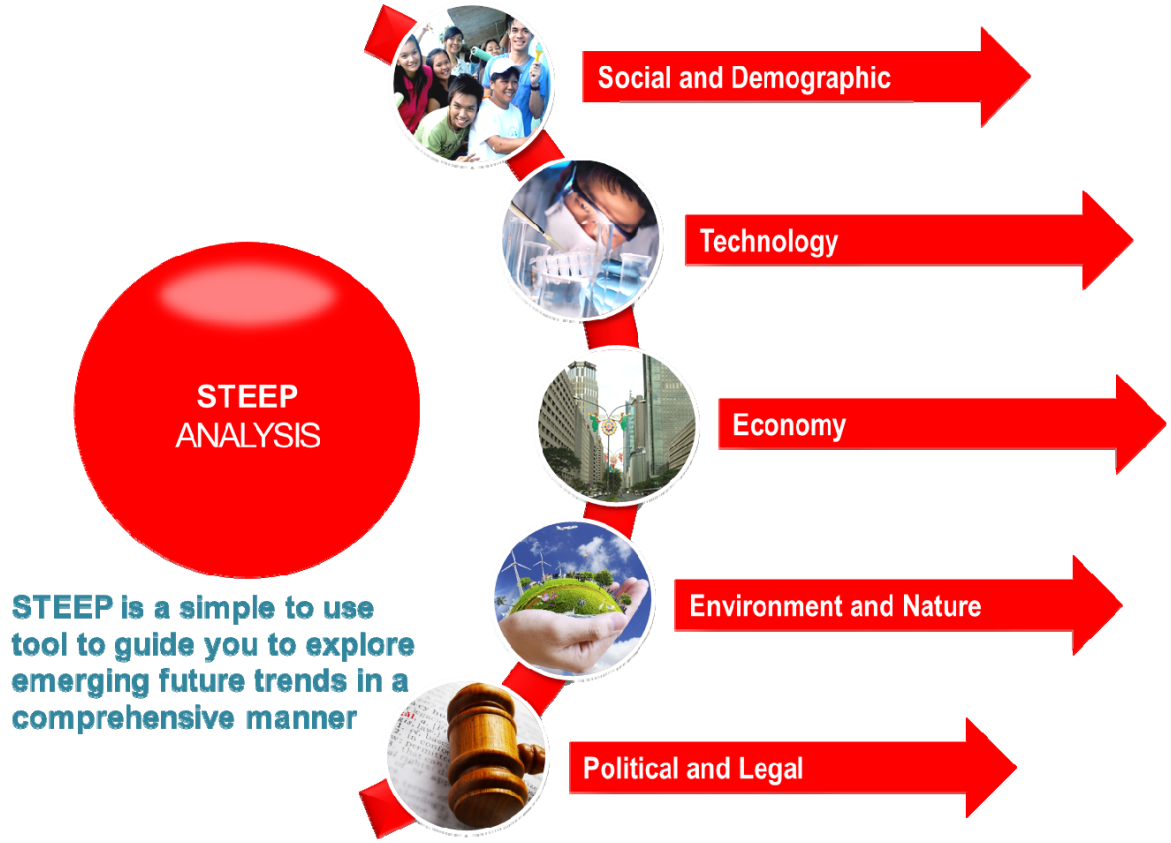
Program Outcome
New Competencies
Graduate Attributes
Curriculum Design
Course Design
Pedagogy
Workspace Design
Quality in Education
Educational Culture
Community of Pedagogical Competence



Curriculum Design & Improvement

STEEP Analysis → New Competency Identification → Graduate Attributes & Program Outcome





STEEP is a simple to use tool to guide you to explore emerging future trends in a comprehensive manner

STEEP Analysis & Future Competency Identification **Team** _____

S Social & Demographic	T Technology	E Economy	E Environment & Nature	P Political & Legal
• Decrease of Population • Aging Population • CLMV labor • Gen Z++	• Industry 4.0: Mass Customization, 3D Printing, Next-Gen Robots, IoT • Thailand 4.0 • Cloud	• AEC • Smart Enterprise, Startup, High Value Service, High skilled labour	• Green society • Renewable Energy • Limited Resource	• World Terrorist • Tax reduction • Unstable Thai political situation • Green Industry Law & Legislation

Future Focus		
Opportunity	**Challenges**	**Future of Work**
• New industries • start-up • new entrepreneur	• Technology change rapidly • Foreign languages	• Mobile working life • Multidisciplinary team based work environment

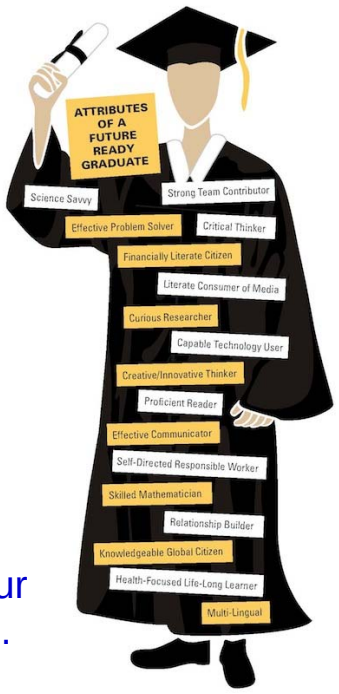
New Competencies to meet opportunity, challenges and working life in the future

- English Language
- IT Literacy
- Productivity Improvement
- Entrepreneur
- Lifelong Learning
- Personal & Professional Ethics

Graduate Attributes

Preparing graduates for jobs that don't exist yet

FUTURE FOCUS
PREPARING FOR WORKFORCE 2020



Prepare graduates as agents for social good in an unknown future

Abilities, dispositions or qualities that we expect our graduates will have, in addition to their discipline knowledge.

What about your future-ready graduated attributes?

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgement and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

Top 10 skills that employers will demands by 2020 and beyond

PE
AUTOMATIC PRODUCTION
CNC TECHNOLOGY
SIMULATION
FORMING
TOOL & DIE
COMPOSITE MATERIALS

IE
QUALITY MANAGEMENT
FEASIBILITY STUDY
PRODUCTIVITY MANAGEMENT
DESIGN OF EXPERIMENT
LOGISTICS
COMPUTER FOR IE

CORE ENGINEERING
Knowledge
Thinking Skills
Teamwork Skills
Communication Skills

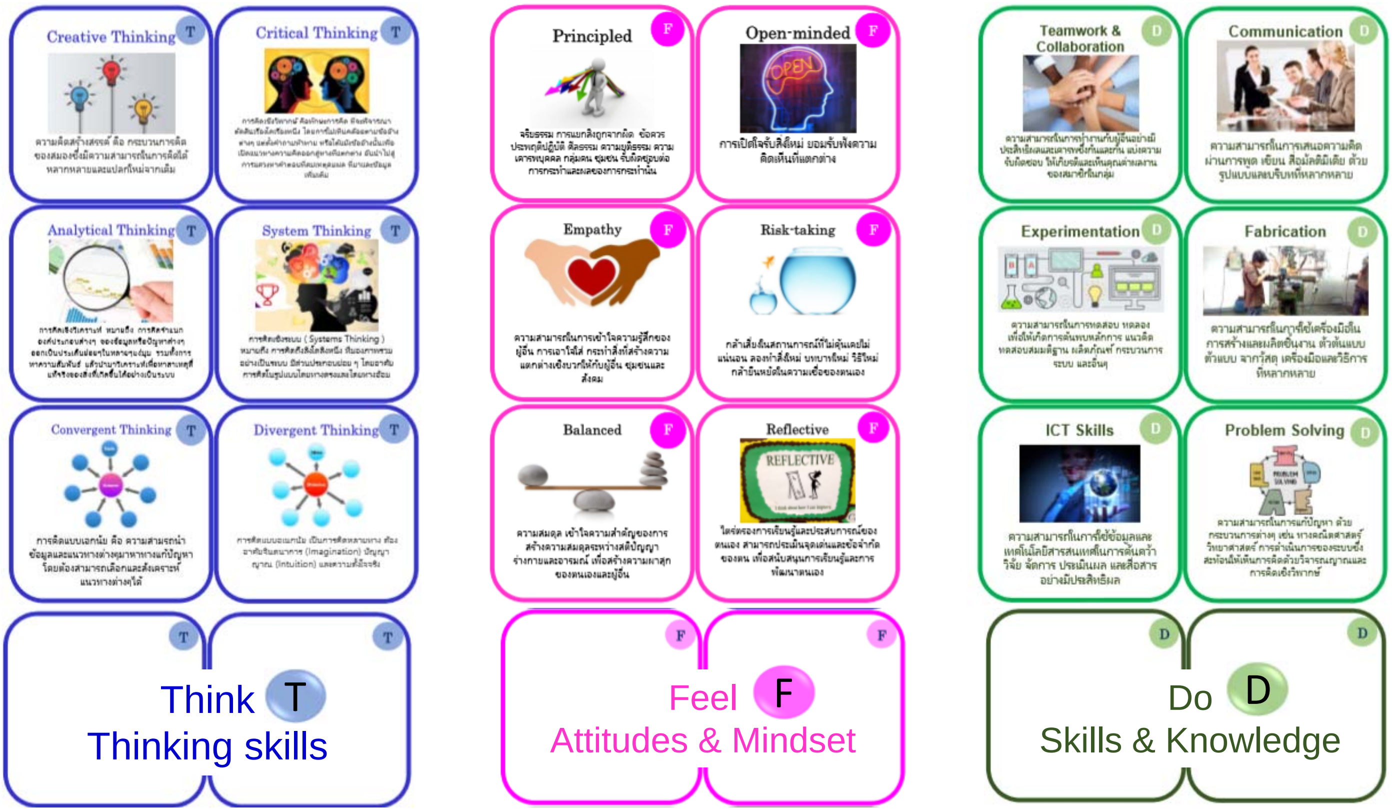
Exercise (30 minutes)
STEEP Analysis & New Competency Identification

STEEP Analysis & Future Competency Identification Team _____

S Social & Demographic	T Technology	E Economy	E Environment & Nature	P Political & Legal

Future Focus		
Opportunity	Challenges	Future of Work

New Competencies to meet opportunity, challenges and working life in the future



Creative Thinking
Critical Thinking
Analytical Thinking
System Thinking
Convergent Thinking
Divergent Thinking
Think T
Thinking skills
Principled
Open-minded
Empathy
Risk-taking
Balanced
Reflective
REFLECTIVE
Feel F
Attitudes & Mindset
Teamwork & Collaboration
Communication
Experimentation
Fabrication
ICT Skills
Problem Solving
Do D
Skills & Knowledge