Introduction for Cross-cultural Engineering Project (CEP) based on Global PBL

Shibaura Institute of Technology (SIT)
FCT, UNIVERSIDADE NOVA DE LISBOA (FCT/UNL)

July 16, 2021

Aim of CEP

CEP enables:

- To acquire the synthetic problem solving capability to be internationally attractive

- To acquire concepts and technologies on "Systems thinking", "Systems Method (Engineering Method)", and "Systems Management (Project Management)"

- To acquire a capability of work as a member of an international and/or interdisciplinary team

Based on Global PBL through the problem solving experience

Cross-cultural Engineering Project (CEP)

- ➤ Global PBL (Project Based Learning) for synthetic problem solving based on multi-cultures and multi-discipline.
- ➤ Design as an engineering educational program based on system thinking.

CEP is held in three area.

1. Glocal problem at KMUTT in Thailand,
2. Industrial & community cooperative at SIT in Japan,
3. Innovative creation at FCT/UNL in Portugal

Time, Venue & Members

Time:　July 27, 2021 – Aug. 5, 2021

Venue: Web based project

Team members*: 48 students
- 14 participants from SIT students
- 8 participants from KMUTT & SUT students
- 10 participants from EU FCT/UNL & TECNUN students
- 6 participants from ITS students
- 10 participants from UCSI students

English Communication (More is better):
Students have to communicate in English, even if they use freely various devices and services, such as electronic dictionaries, smartphones and the Internet.

*Both sides should be composed of graduate school student, 4th year undergraduate students.

Role of TA & Professor

Role of Teaching Assistants (TA):

4 students from SIT,

3 students from FCT/UNL.

TAs advise the teams to coordinate with the local staff, to support the management of teams.

Role of Professors:

Professors act as an assumed investor to project. They make various kinds of comments and suggestions in the Design Review (DR).

Comments from various points of view among lecturers are allowed.
Basic stance is to pay respect to students' ideas and opinions;
The lecturers should not force the students to follow their comments.

Oh My God Experience

In CEP, unexpected troubles, which people meet with very frequently in the real world, will be induced by intention.

This "Oh my God" experience should trigger the improvement of competency.

Each team will be requested to reconstruct the process of solving the problems by rescheduling.
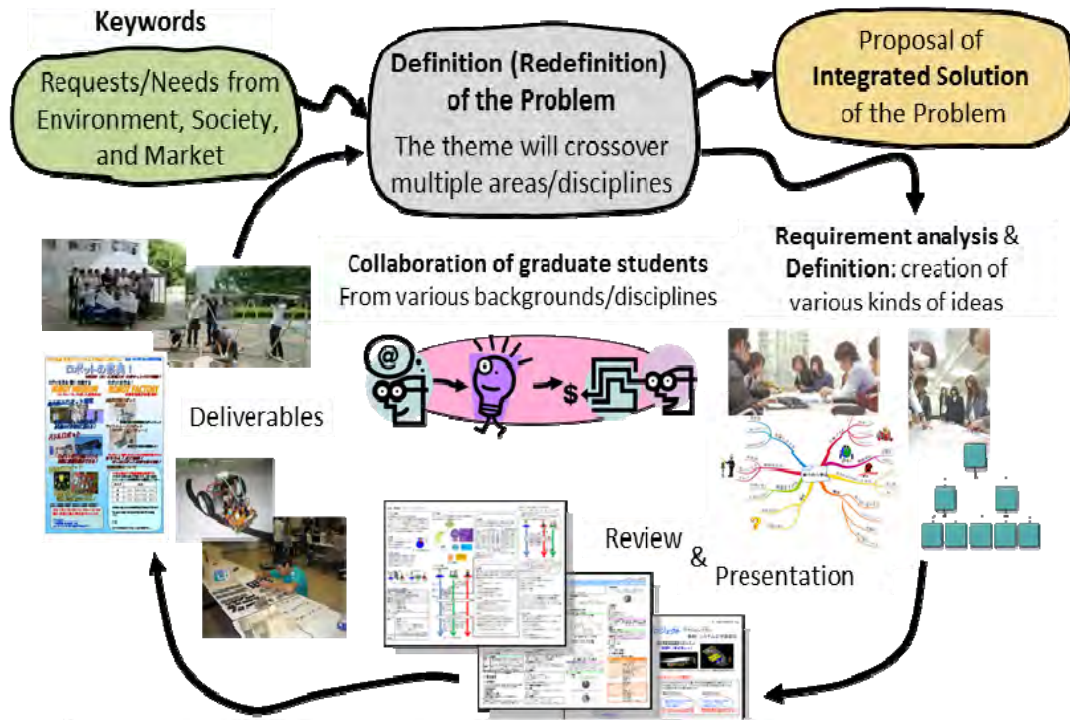
Improvisation Education*

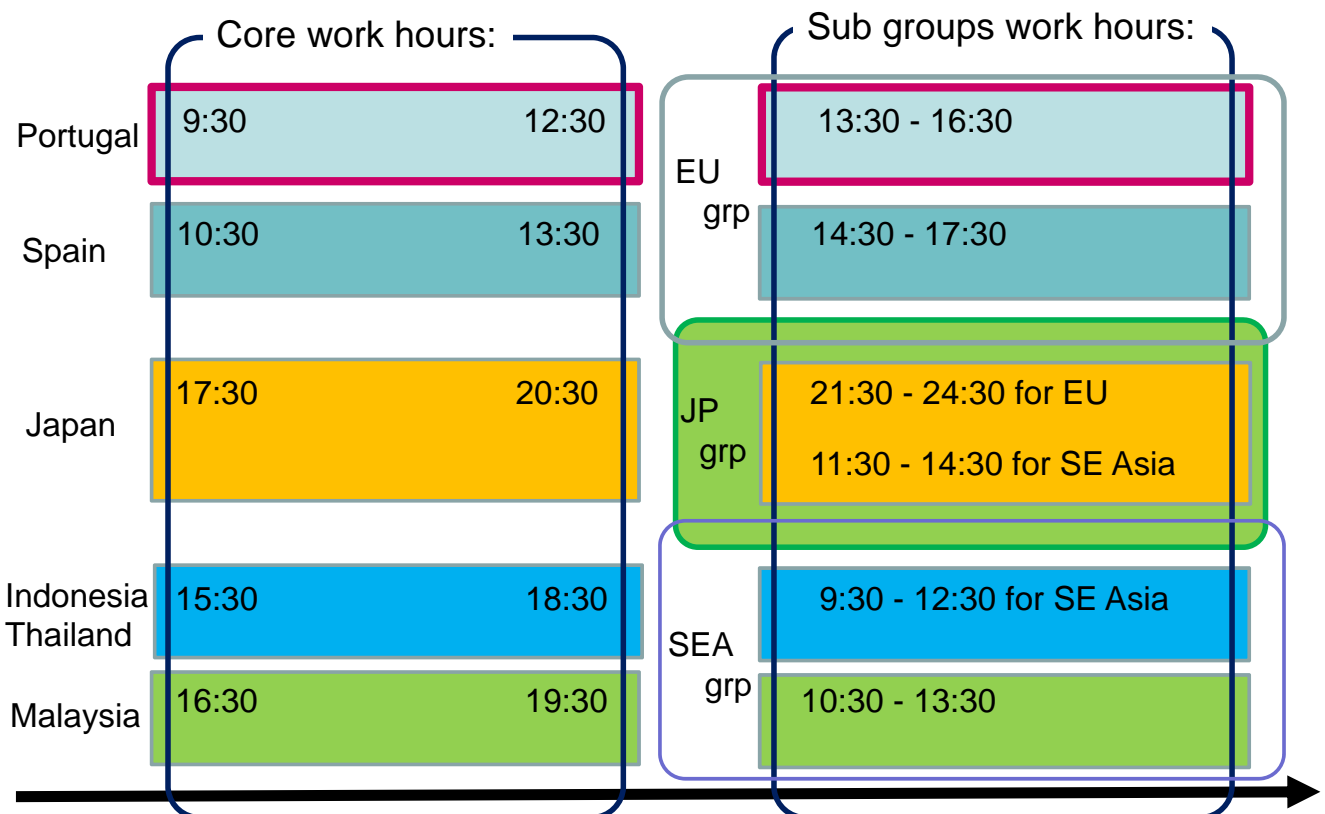Creatively adaptation skill to unexpected changes in a project

* Improvisation education has been performed to obtain creatively adaptation skill to unexpected changes in a project. As an examples, MIT and Stanford.

Practical Process

The solution would be formed by correlating various science and technology each other, which has been obtained through environment and social activities

Time line

Core work hours:

Sub groups work hours:

	Core	Sub group
Portugal	9:30 — 12:30	13:30 - 16:30
Spain	10:30 — 13:30	14:30 - 17:30
Japan	17:30 — 20:30	21:30 - 24:30 for EU / 11:30 - 14:30 for SE Asia
Indonesia Thailand	15:30 — 18:30	9:30 - 12:30 for SE Asia
Malaysia	16:30 — 19:30	10:30 - 13:30

EU grp

JP grp

SEA grp

Euro (Portugal & Spain)

WEST UTC+1		Project activities
Pre Process	Web form	1st outcomes assessment (Rubric) and Team-Forming questionnaire
Day 1 (T, July 27)	Core work Sub groups work	Guidance and Icebreaking Problem finding and gathering needs and technologies
Day 2 (W, July 28)	Core work Sub group work	Confirmation of the theme by KJ method or Mind Map Deploy needs and technologies on QFD through requirement analysis
Day 3 (T, July 29)	Core work Sub groups work	Gather **Kando Quality (Emotional requirement) & deploy KQ on QFD** Deploy function (solution) on QFD for needs, technologies and KQ
Day 4 (F, July 30)	Core work Sub groups work	Deploy inventive solution using **Contradiction Problem** on QFD matrix
Day 5 (S, July 31)	Sub groups work	Goal setting of business model Preparation of Design Review (DR)
Day 6 (M, Aug. 2)	Core work	Design Review (DR)
Day 7 (T, Aug 3)	Sub groups work	Reset goal and reschedule for the activities via DR's comments Remake business model in accordance with the planned schedule
Day 8 (W, Aug. 4)	Sub groups work	Decide business model in accordance with the planned schedule Preparation of the final presentation
Day 9 (T, Aug. 5)	Core work Core work+2h	**Final Presentation** Closing ceremony
Post Process	Web form	Report of Expenditures and 2nd Outcomes assessment PROG competency test

Japan & South East Asia

|		Project activities
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Cyber & physical space
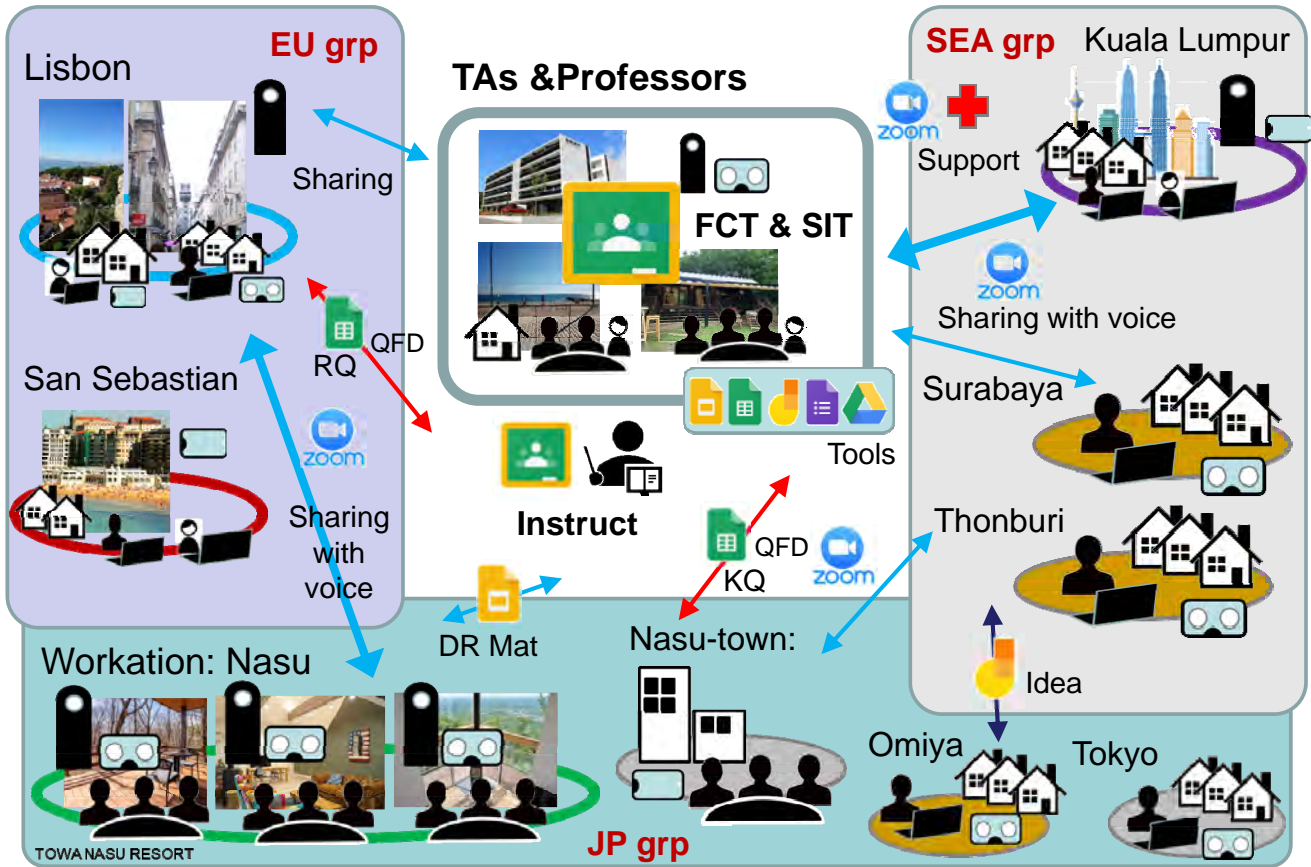
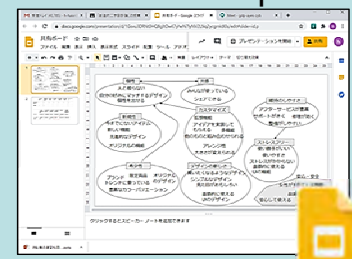RQ: Requirements Quality, KQ: Kando Quality, DR Mat: Design Review Material

slack and Google drive & tools

1. **Announce and Instruct for the whole by slack**
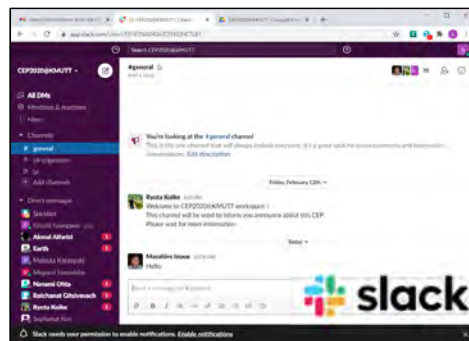
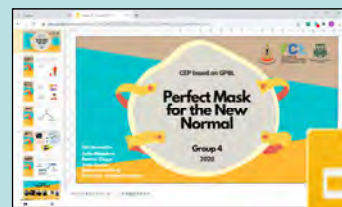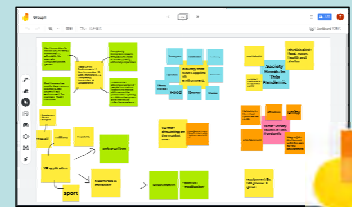2. **Work in each team on Zoom.**

    Using the google applications on Google Drive

Day 1:

Icebreaking & Team-Forming

Icebreaking:

Self introductions and team-forming through simple game for communication and questionnaire
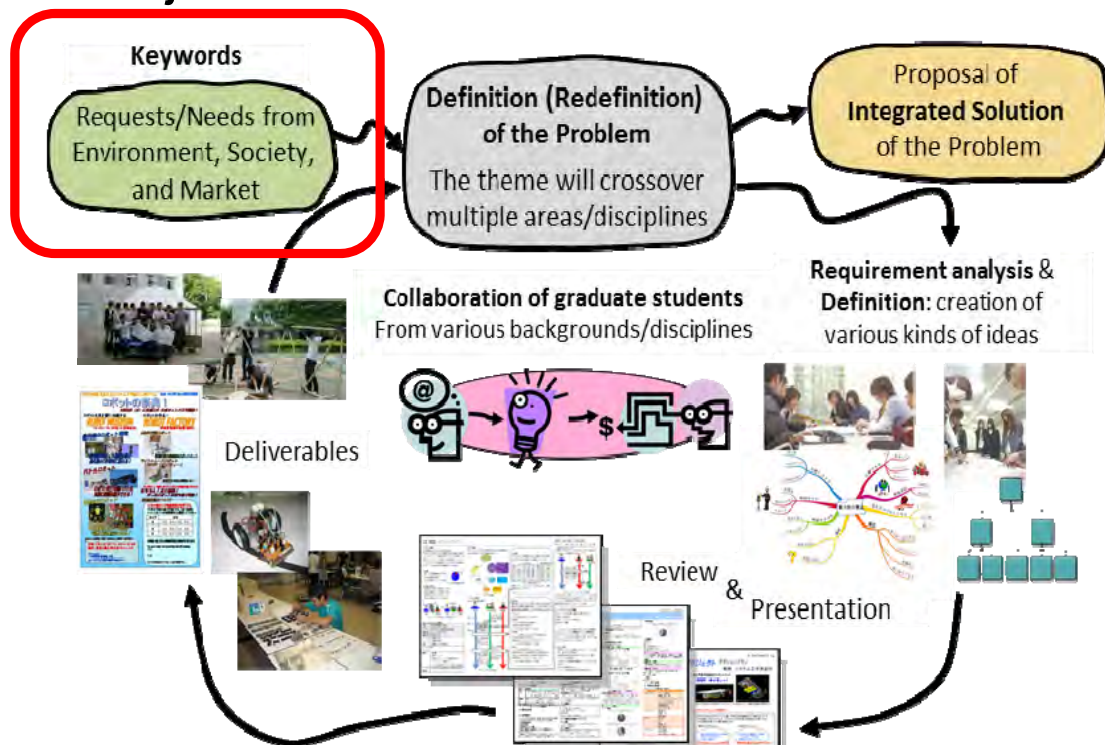
Team Formulation:

Total of 8 teams of 6 students.

自己紹介ゲームの様子

ニックネームの発表

日本人とタイ人でバディ(ペア)を組みました

Day 1:

Project's theme

Keywords

Requests/Needs from Environment, Society, and Market

Definition (Redefinition) of the Problem
The theme will crossover multiple areas/disciplines

Proposal of Integrated Solution of the Problem

Requirement analysis & Definition: creation of various kinds of ideas

Collaboration of graduate students
From various backgrounds/disciplines

Deliverables

Review & Presentation

The solution would be formed by correlating various science and technology each other, which has been obtained through environment and social activities

Day 1, 2:
Project's theme

Some keywords should be referred for setting the theme.

All through the project, students are expected not only to make a plan but also make a design, implementation and a fieldwork.

Keyword:

Ecology, Energy, Eco-tourism, Community development, Service, Mobility, Welfare and medical system, Disaster prevention, Multi-language communication, User experience, Innovation, Education system, Global leadership, Unexamined Patent, Others (student's idea)

Day 1, 2:
Definition of the problem
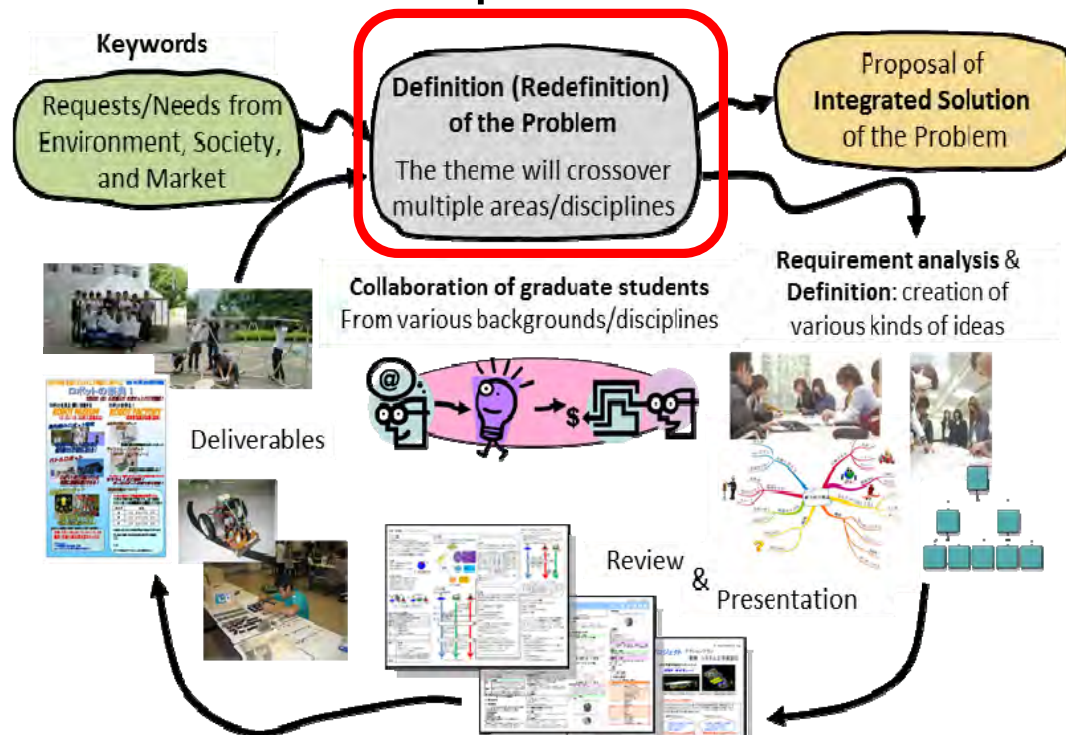
The solution would be formed by correlating various science and technology each other, which has been obtained through environment and social activities

Day 1, 2:
Definition of the problem

Problem finding and gathering needs and technologies

Using learned methods and thinking process in Systems Engineering courses as a systematic communication tools, such as Brain Storming, KJ method, Mind map et al.

Using sticky notes during discussions open to any challenge

To add fined Requirement Quality (RQ) to this area

Deliver and add RQ on the QFD matrix between each the group of EU, JP, and SEA

Day 3:
Requirement Analysis and Definition
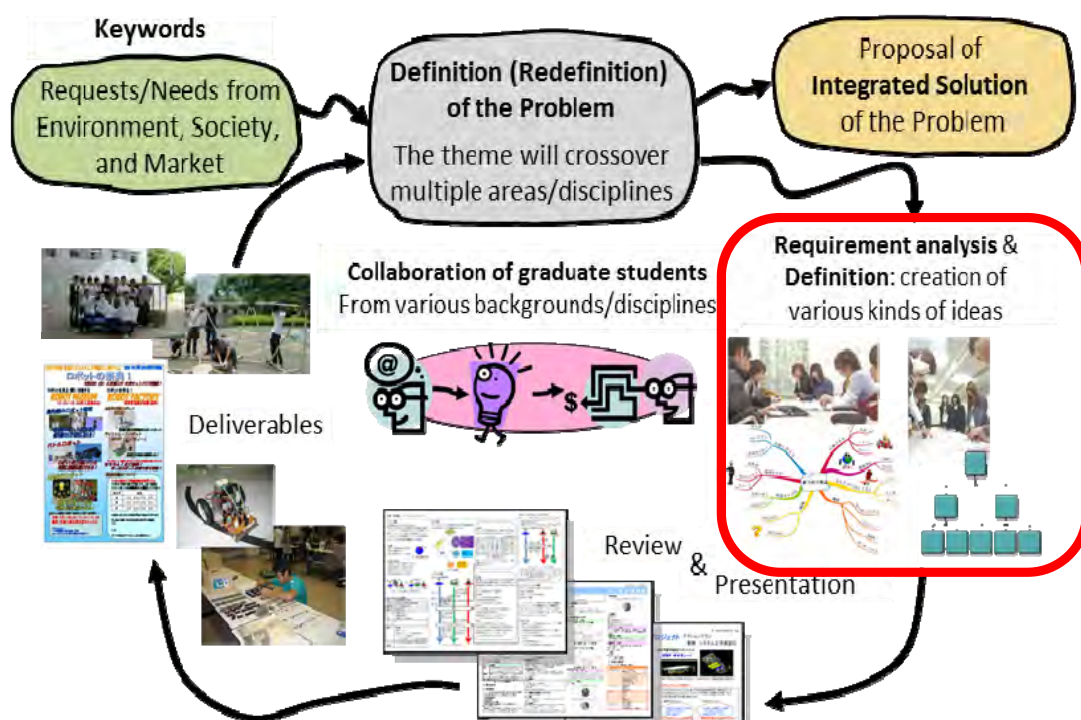
Keywords

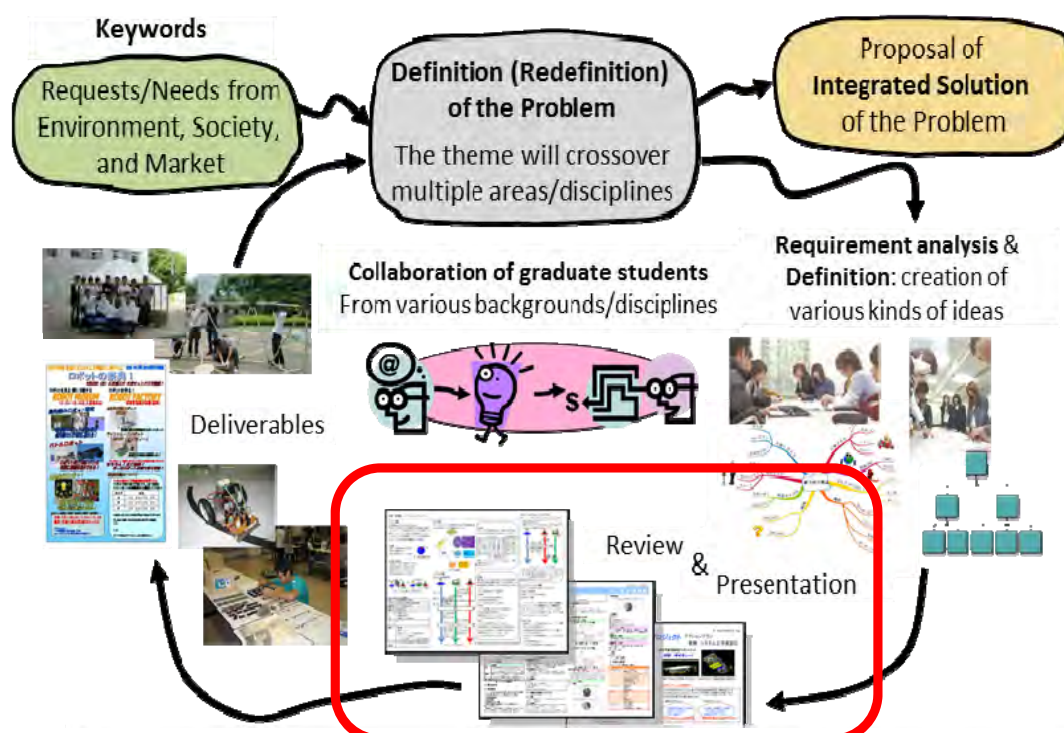Requests/Needs from Environment, Society, and Market

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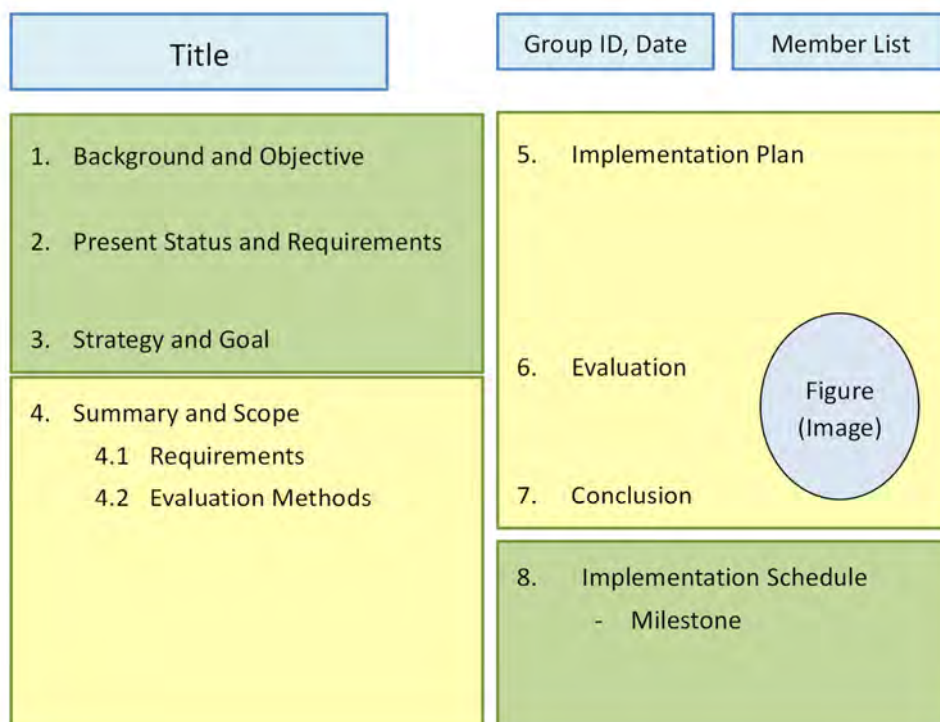
Day 3:
Attractive Quality

◆ Introduce viewpoint of Product Quality (PQ)
◆ Apply Kano model for PQ

Kano model has classified the product quality into five categories.
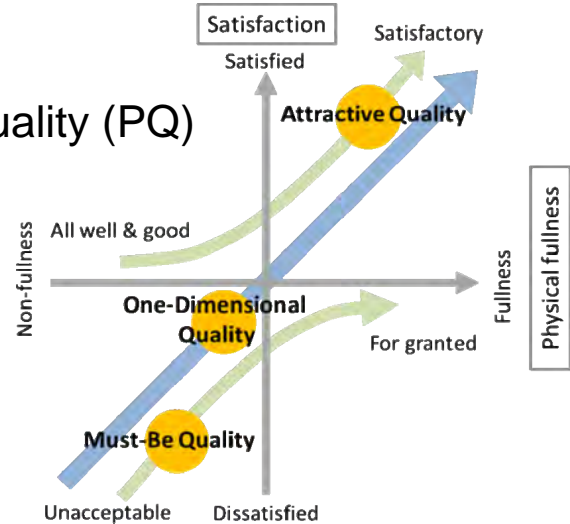
Evaluations of same quality element through progress of time change with "AQ -> ODQ -> MBQ".

Quality elements	Customer response	
	Fullness of Quality	Non-fullness of Quality
Attractive Quality (AQ)	Satisfaction	All well and good
One-Dimensional Quality (ODQ)	Satisfaction	Dissatisfaction
Must-Be Quality (MBQ)	Taking for granted	Dissatisfaction
Indifferent Quality (IQ)	Not provide satisfaction and dissatisfaction	
Reverse Quality (RQ)	Dissatisfaction	Satisfaction

Day 3:
① Kando Quality (Emotional requirement) finding

Problem Understanding
- Physical requirements
- Functional requirements
- Human requirements
- Economic requirements

Need & Technologies

Kando Understanding

QFD Matrix:

Requirement Qualities
Kando+Needs

Solution

Kando Quality

TRI

Fieldwork
Problem finding
Gathering needs & technologies

①
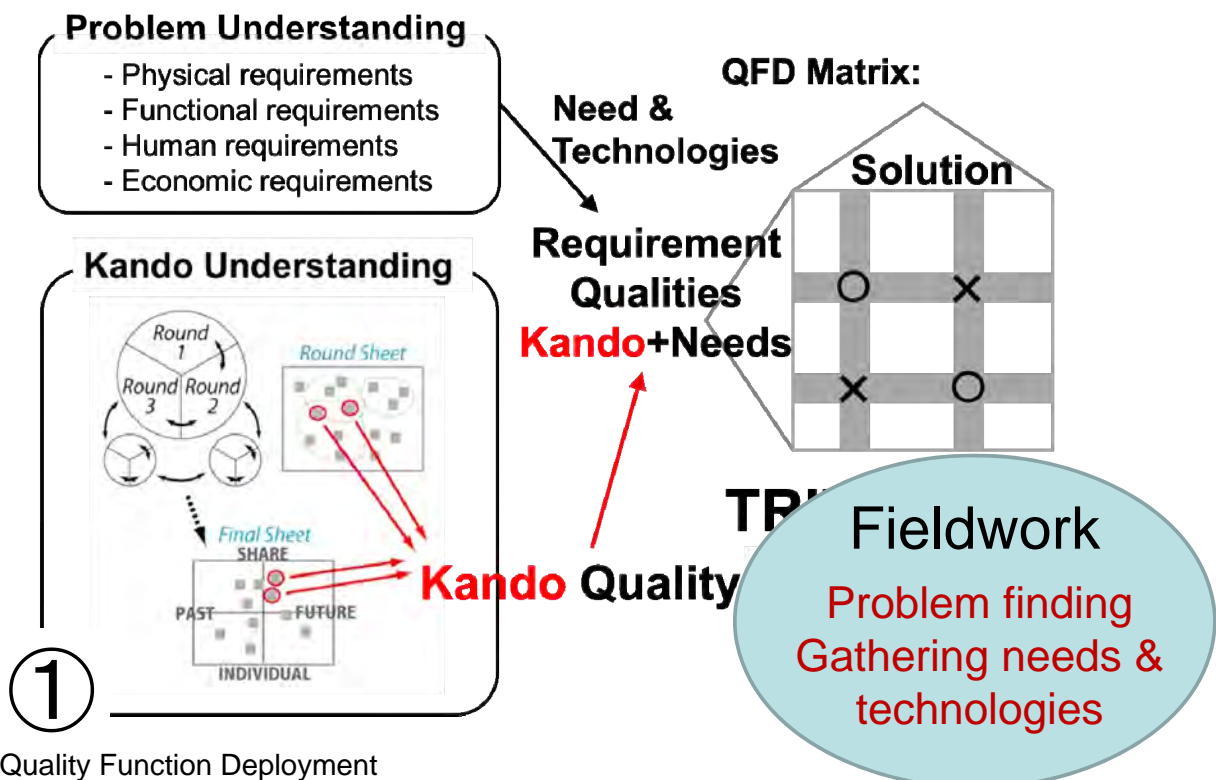
QFD: Quality Function Deployment

Day 3:

Definition of Kando Quality (KQ)

Kando Quality

Feel historical something in my heart

Deliver and add KQs on the QFD matrix between each the group of EU, JP, and SEA

To add fined Kando quality to this area
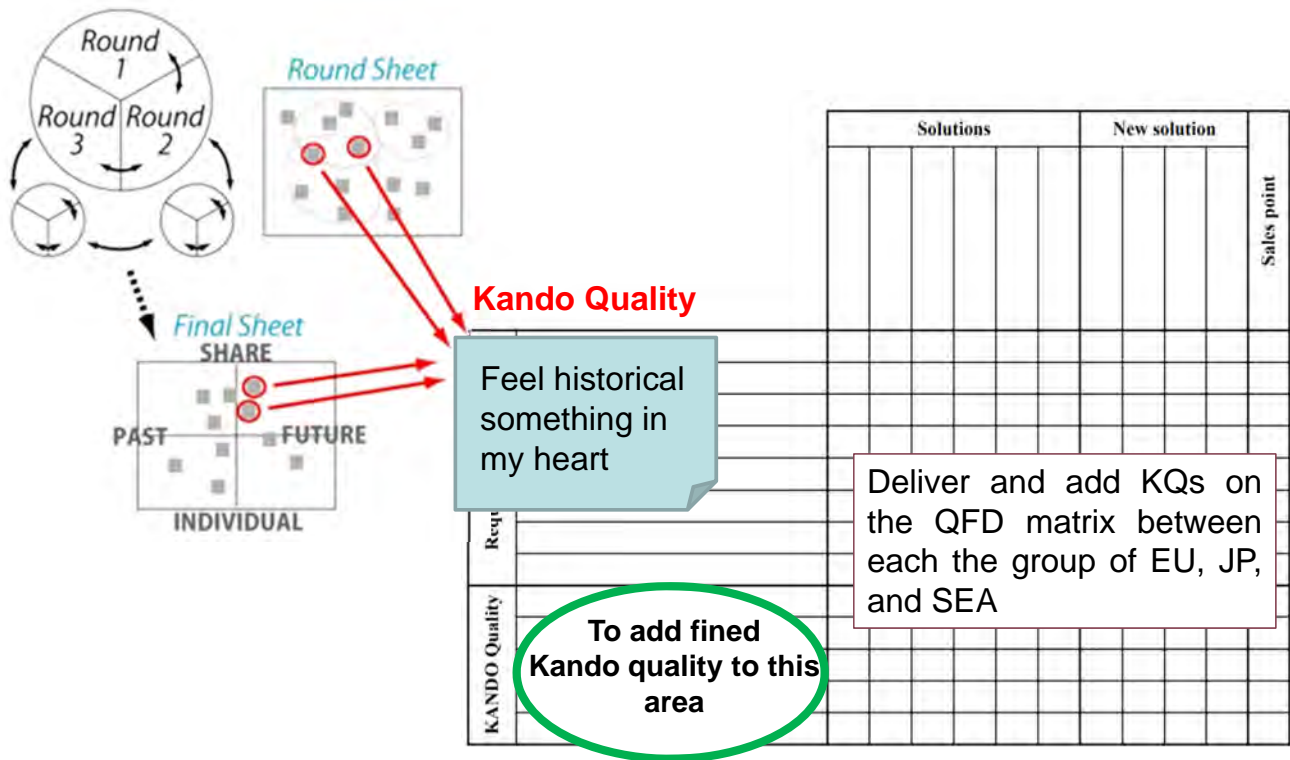
Day 4:

② Definition of needs & technologies on QFD
③ Deployment of function (solution) on QFD
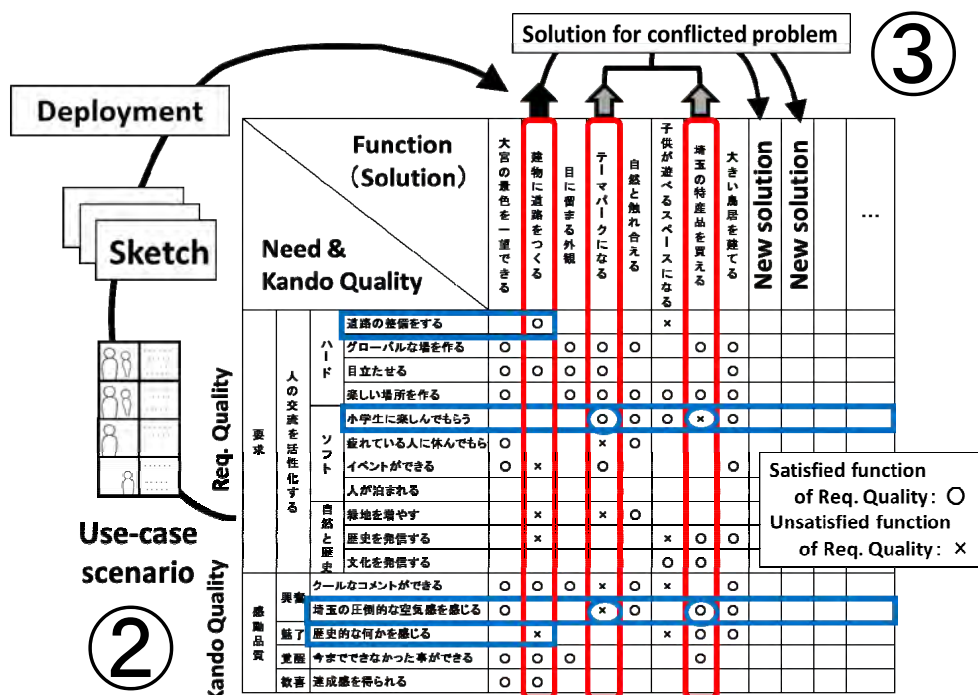
Day 4:

④ Inventive solution using Contradiction Matrix

Problem Understanding
- Physical requirements
- Functional requirements
- Human requirements
- Economic requirements

Need & Technologies

QFD Matrix:

Solution

Requirement Qualities
Kando+Needs

Kando Quality

Kando Understanding

Round 1
Round 3 Round 2

Round Sheet

Final Sheet
SHARE
PAST   FUTURE
INDIVIDUAL

Contradiction solving

Idea

QFD: Quality Function Deployment

Day 5:

Goal setting and others planning

- ✓ Goal setting
- ✓ Assessment planning
- ✓ Budget planning
- ✓ Schedule planning for activities

Comments and suggestions for improvement from students and TAs
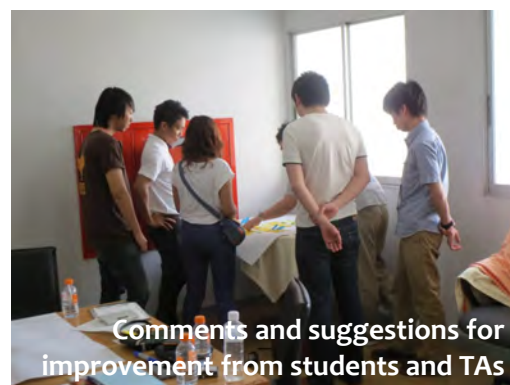
- ✓ Preparation of design review (DR) materials

Using learned methods and thinking process in Systems Engineering courses as a systematic communication tools, such as 5W1H, Logical tree, Matrix method, Quality Function Deployment etc.

OMG's Day:

Team activity: Improvisation education produced by OMG Professor with TA
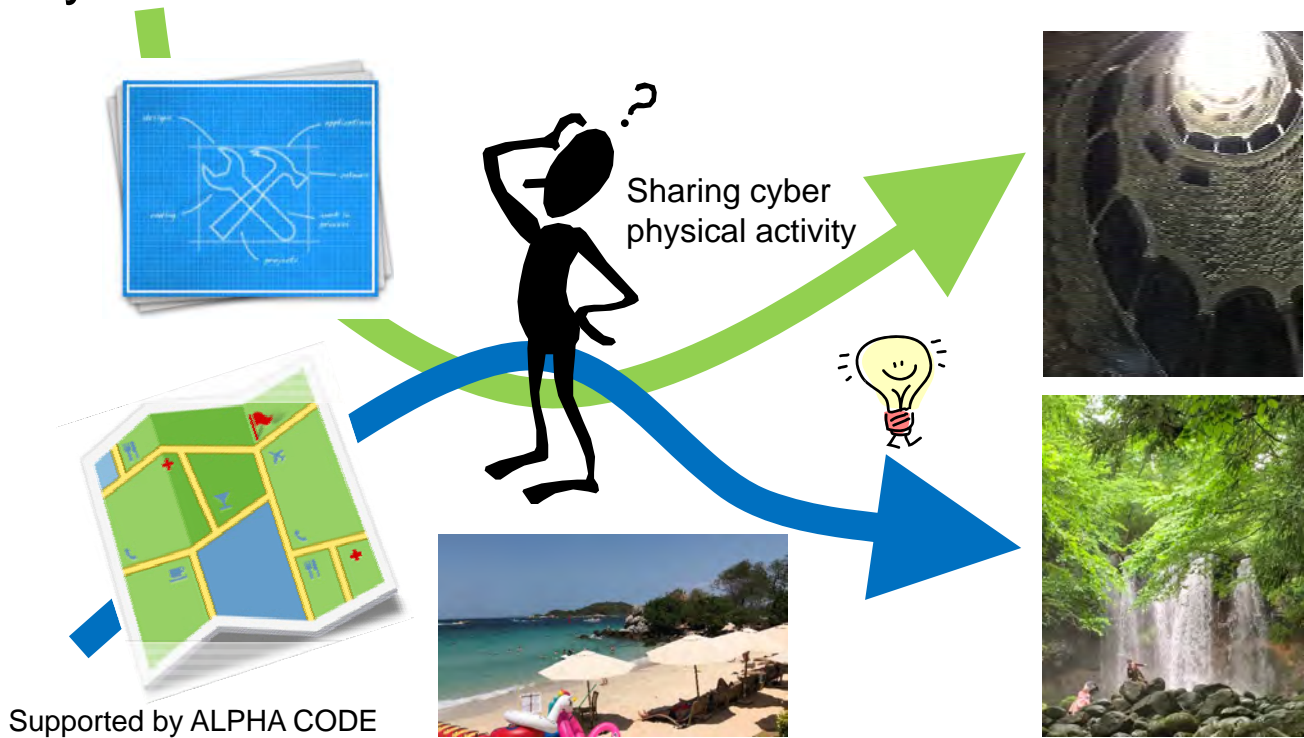
Sharing cyber physical activity

Supported by ALPHA CODE

Day 6:

Design Review

Keywords

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Requirement analysis & Definition: creation of various kinds of ideas

Deliverables

Review & Presentation

The solution would be formed by correlating various science and technology each other, which has been obtained through environment and social activities

Day 6:

Standard of Evaluation for DR

In DR, evaluation is made with scale from 1 to 5, by using the standards (1) through (6) shown below.
The actual evaluation will be conducted in 2 levels consecutively; (a) Evaluation by students among groups, (b) Evaluation by the professors and TAs.

(1)   What are the requirements for the theme?
- Are Background and Objective stated clearly?
- Are Present Status and Needs analyzed well?
(2)   What is the goal to meet the requirements?
- Are any ideas and proposals clearly described to reach the goal?
(3)   Was the relationship between Requirements and Goal an appropriate one?
(4)   Was the Evaluation Method planned properly?
(5)   Was the Budget Plan planned properly?
(6)   Did the resource and the oral presentation help your understanding?

Day 6:

A3 Material for DR

| Title | | Group ID, Date | Member List |

Left Column	Right Column
1. Background and Objective	5. Implementation Plan
2. Present Status and Requirements	
3. Strategy and Goal	6. Evaluation — Figure (Image)

4. Summary and Scope
  4.1 Requirements
  4.2 Evaluation Methods
	7. Conclusion

	8. Implementation Schedule - Milestone

A3 Material is used for DR at many Japanese companies, such as automotive or electric-appliance companies, Mitsubishi, Toyota…

Day 6:
A3 Material for DR

Day 7:

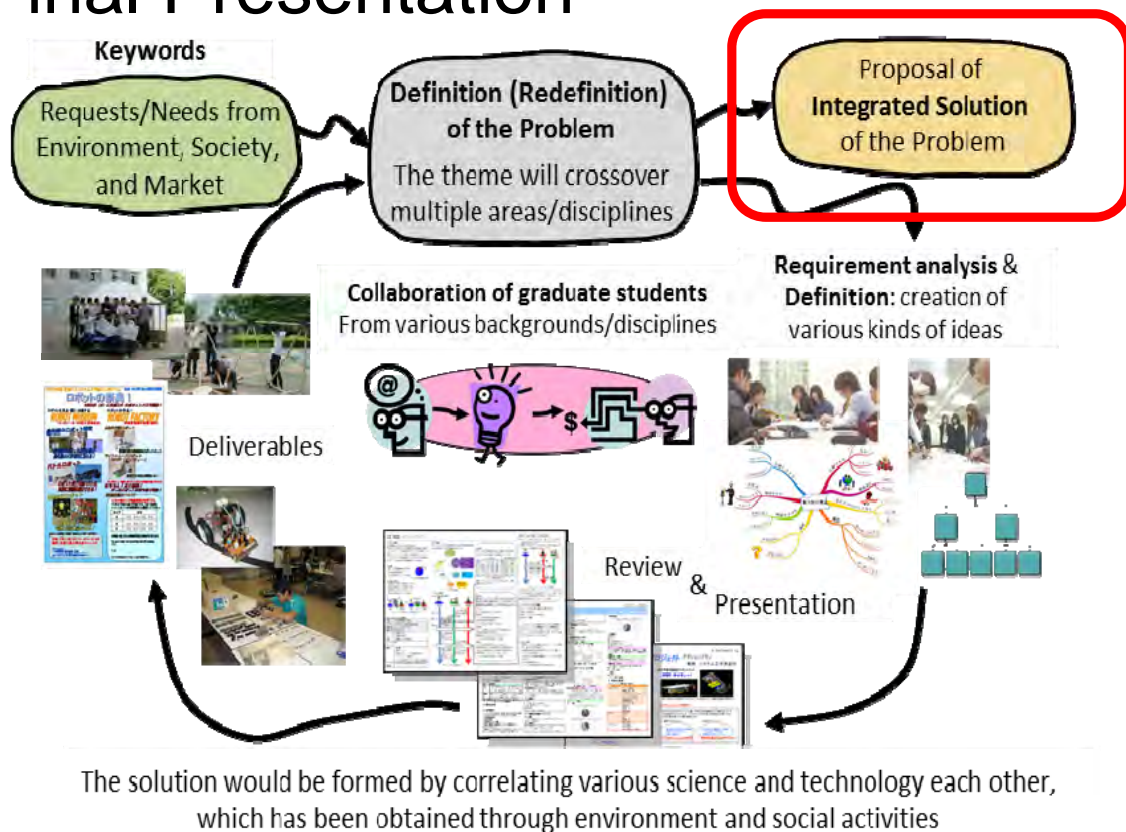## Resetting goal and reschedule for the activities via DR's comments.

- ✓ Re-requirement analysis
- ✓ Goal setting
- ✓ Assessment planning
- ✓ Schedule planning for activities
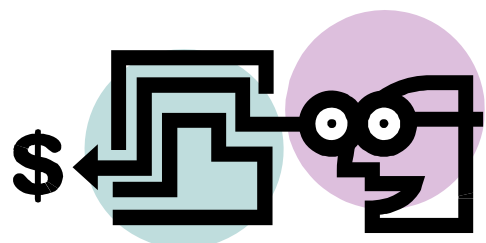
Day 7, 8: Scheduled Actions

◆ Activities (Business model) in accordance with the planned schedule

Day 9: Final Presentation

Day 9:
Final Presentation material

The A3 Material should include following points for the final presentation.

Background and Objective
Requirement Analysis
    Present Status and Needs, Objective Analysis
    Requirements, Strategy, and Goal
    Criteria plan for evaluation
Implementation
    Summary and Scope
    Implementation Plan
Evaluation
    Evaluation Method
    Evaluation Result
Conclusion

A3 Material

Final Presentation

Day 9:
Standard of Evaluation
for Final Presentation

The final presentation are evaluated with scale from 1 to 5, based on the following evaluation standards.
The actual evaluation will be conducted in 2 levels consecutively; (a) Evaluation by students among groups, (b) Evaluation by the professors and TAs.

(1) Creativity: Did the group obtain creative results?
(2) Usefulness: Did the group obtain results that hit the point of the theme, which is useful in general or global problem solving?
(3) Completion: Did the group obtain results with higher degree of completion through analysis, plan, and evaluation?
(4) Feasibility: Did the group set a goal with an adequate level of feasibility?
(5) Achievement to the Goal: Did the group achieve the goal that was set at the beginning?

Day 9:
Final Presentation

Evaluation criteria for Project Deliverables:
・Creativity　　　　・Usefulness
・Completion　　　・Goal-appropriate
・Goal Achievement
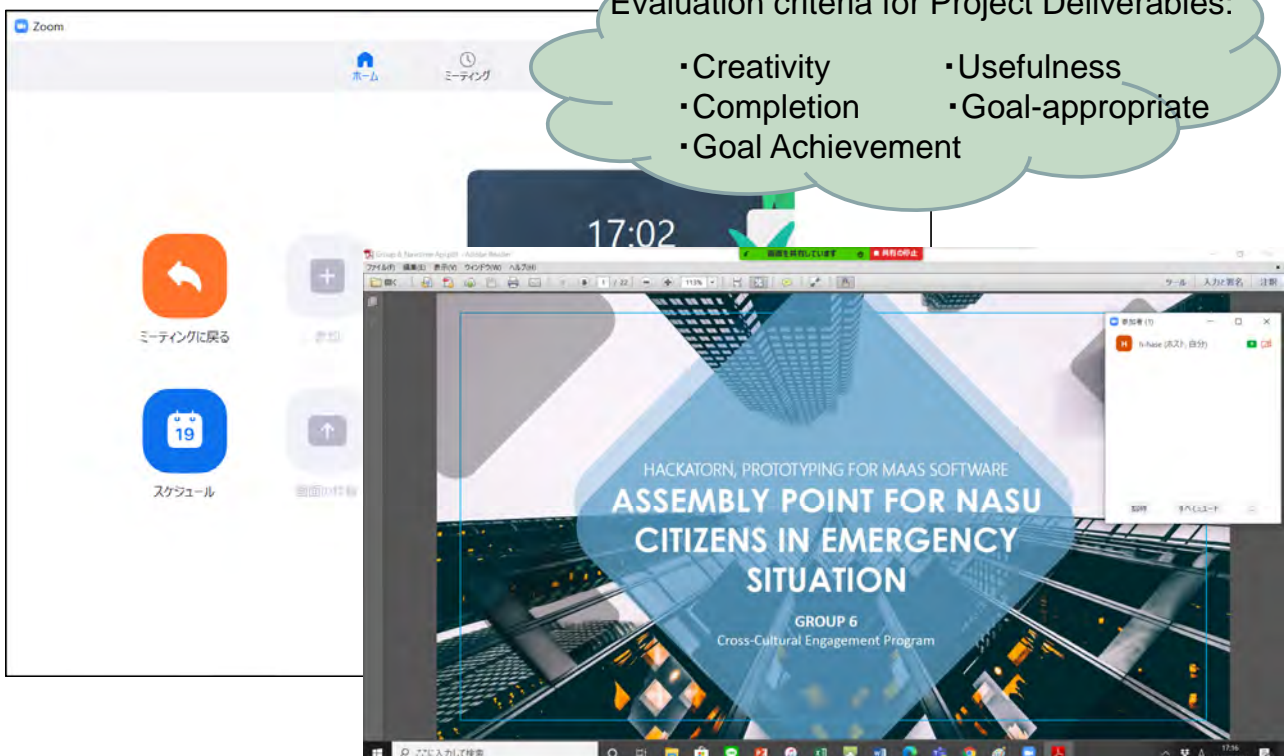
Day 9:
Outcomes Assessment

gPBL Outcomes Assessment Sheet · (for student) · YYYYMMDD: _____

Department:

Group Number : · Bachelor/Master · Grade: · Student Number: · Name:

Personal Outcomes Assessment by yourself and peer students (High:5,4,3,2,1:Low)

	Learning Outcomes	Competency	Self Assessment Pre gPBL	Self Assessment Post gPBL	Peer #1 Student Name	Peer #2 Student Name	Peer #3 Student Name	Peer #4 Student Name	Peer #5 Student Name	Peer #6 Student Name	Average of Peer
Personal Outcomes	Work in multi-culture and interdisciplinary team	Communicate and teamwork in multi-culture and interdisciplinary team									
	Engineering Design	Design system, service and process which satisfy needs and constrains									
	"System Thinking" - Solve interdisciplinary problem by understanding engineering process.	1.Understand engineering process and apply it to solve interdisciplinary problem 2. Recognize and analyze problem, and design and evaluate solution.									
	"Engineering Methodology" - Apply engineering methodologies to solve interdisciplinary problem.	1.Understand engineering methodologies and apply them to model, and determine system.									
	Leadership (especially for graduate student)	Can find out about a situation and can lead the leadership in quick response to the status of group.									

Team Outcomes Self Assessment (High:5,4,3,2,1:Low)

	Project Outcomes	Description	Self Assessment Post gPBL
Team Outcomes	Creativity	Propose creative system and service	
	Usefulness	Propose useful system and service	
	Completion	Obtain results with higher degree of completion through analysis, plan, and evaluation	
	Feasibility	Technically, socially and economically feasible	
	Achievement	Achieve goal	
	Written and Oral Presentation	Written presentation	
		Oral presentation	

Comments and Suggestions on the gPBL

What did you obtain from the gPBL

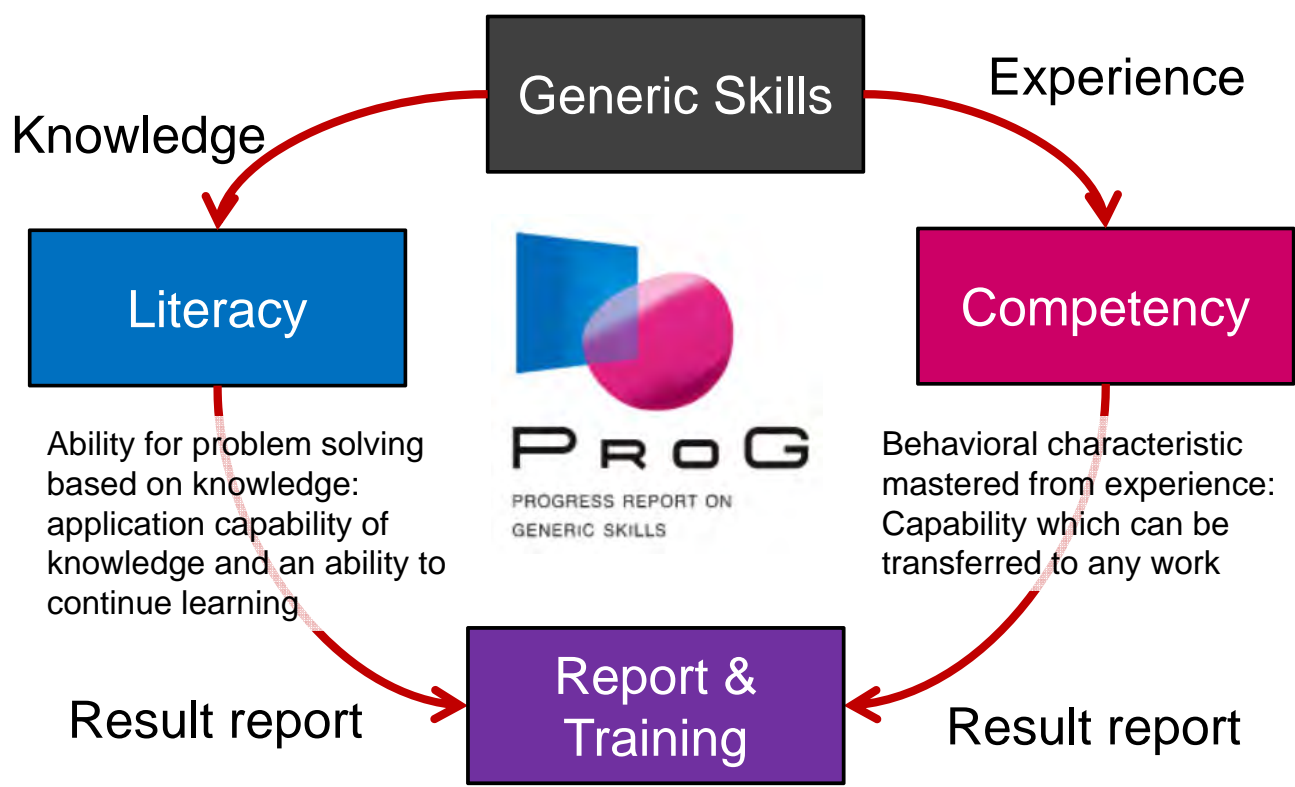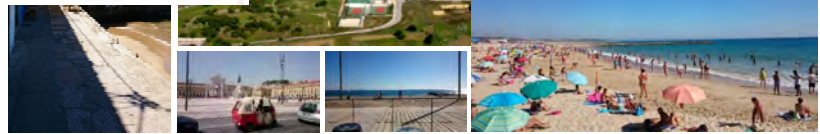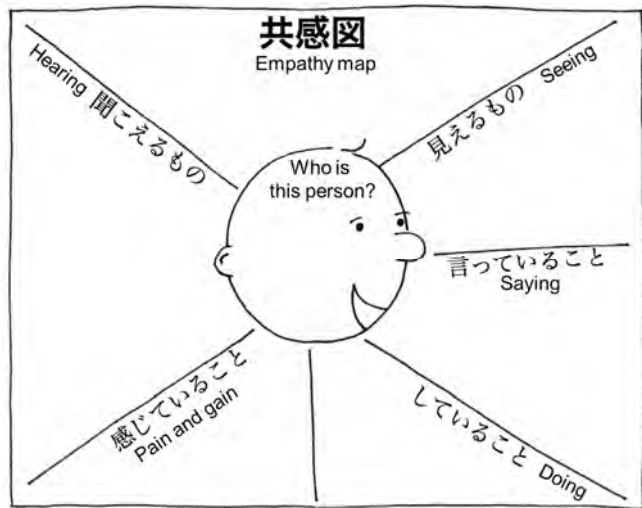> Evaluation on Learning Outcomes is made after the Global PBL was completed.

> The actual evaluation will be conducted in three levels consecutively;
> (a) Evaluation by students within the same group,
> (b) Evaluation by students among groups, (c) Evaluation by the professors and TAs.

Day 9:
Progress Report On Generic skills (PROG)

Generic Skills

Knowledge · Experience

Literacy · **Competency**

ProG — PROGRESS REPORT ON GENERIC SKILLS

Ability for problem solving based on knowledge: application capability of knowledge and an ability to continue learning

Behavioral characteristic mastered from experience: Capability which can be transferred to any work

Report & Training

Result report · Result report

Let's exercise

共感図
Empathy map

Hearing 聞こえるもの

見えるもの Seeing

Who is this person?

言っていること Saying

感じていること Pain and gain

していること Doing

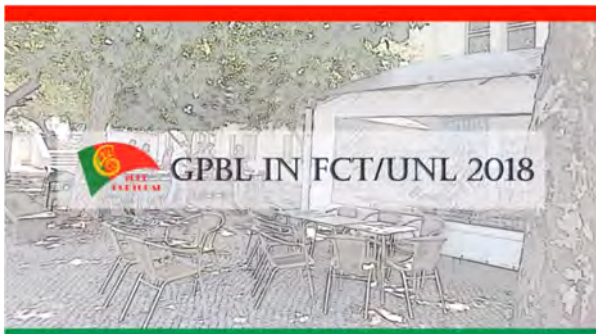## Let's exercise on CEP at Web based PBL

Activities in CEP

Last year GPBL

GPBL IN FCT/UNL 2018

https://www.youtube.com/watch?v=KMVEkB6M7GM

gPBL@FCT/UNL 2017

gPBL PORTUGAL

https://www.youtube.com/watch?v=Ssh1R9A5r3M