Innovative Engineering Education with Community-Based Projects at Kanazawa Institute of Technology
1. Introduction

Circumstances
Surrounding
Universities &
Higher Educational Institutions
Change of circumstances surrounding Japanese universities (KIT)

- Practice trends in science & technology/
  Diversity, refinement and integration trends in academic fields/
  Progress in computer-aided technology/
  Interest in environmental and energy problems

- Change of student disposition due to affluent lives/
  Problems in learning => Decline in academic interest and motivation for learning

- From rote memorization to applicable, practical, and creative activities/
  Importance of innovation in engineering

- Development of pedagogy

Need to change existing education systems and teaching methods
2. Engineering Education at Kanazawa Institute of Technology (KIT)

1) Transition of KIT-Education
Recent Progress in engineering education at KIT

From the latter part of 20\textsuperscript{th} century: Reformation & renovation on a global scale

**Yume-koubou (1993), Engineering design education, Project Based Learning, Team activity, …**

KIT educational reform (1995-)
Curriculum with project-based design course as the main pillar

Feedback and reforms:
To foster “active-minded engineers” who can succeed in real world

KIT joins CDIO-initiative in June 2011

Center of Community:
University which can communicate with local community

The 5\textsuperscript{th} educational reform
2) Educational Goal: What kind of engineers does KIT aim to nurture?
What attributes should graduates of KIT acquire?

KIT Educational Goal:

Engineers who can act with initiative based on creative thinking

Nurture of human resources who can succeed in a real (industrial) world
To be Successful Engineer in Real Industrial World

Comprehensive Abilities

Gaku-Ryoku:
- Academic Abilities & Skills
  - Disciplinary Knowledge and Skills, ...

Ningen-Ryoku:
- Personal and Interpersonal Abilities & Skills
  - Communication, Leadership, Collaboration, Presentation, ...

KIT Education

Two important competencies in KIT education
Gaku-Ryoku = Academic Abilities & Skills
Knowledge and skills in discipline

Ningen-Ryoku = Personal and Interpersonal Abilities & Skills in KIT
(1) Independence and Autonomy
(2) Leadership
(3) Collaboration skill
(4) Presentation skill
(5) Communication skill

* Red colored words = in Japanese
3. Fundamental Elements in KIT Educational Program
Four Elements in KIT-Educational Program

A) Curriculum

B) Workspaces

C) Learning Methods; Class-Work & Extracurricular activities

D) Reflection and Feedback
Outline of KIT curriculum 2012

International Standard-Directed Curriculum with its pillar of Project-Design Education

Graduate school for Master & Doctoral Courses

Disciplinary Subjects in Mechanical Engineering, Electrical Engineering, ….
B) Workspaces

Yume-Koubo: The Factory for Dreams and Ideas

Library Center, Innovation & Design Studio, Entrepreneurs-Lab, 24hours-study room,

Project Design Center

Team activity by Cutter in Anamizu Bay

Anamizu-Bay Seminar House

- Robot
- Human powered aircraft
- Human powered boat
- RoboCup
- GPS boat
- Wind powered generator
- Electric vehicle
- Model making
- Solar car
- Eco run
- Conveyance vehicle
- Solar boat
- Emergency robot
- Formula car
Research Campus in Yatsukahao

Project Design Ⅲ: Senior (Graduation) Project Research in graduate students (M.C. & PhD)
Victory at ABU Asia-Pacific Robot Contest 2013

An Example of Extracurricular (Yume-Koubou) Projects
Courtesy Call
on Prime Minister Shinzo Abe
as the representative of Japanese universities
ABU Asia-Pacific Robot Contest 2013
Vietnam
C) Learning Methods; Class-Work & Extracurricular Activities

From Teacher-Centered Education
To Learner-Centered Education
Engineering Practice Skills: CDIO

- Functional
  - Design & build
  - Operate & repair
- Professional
  - Ethics & Integrity
  - Behavior
- Personal
  - Thinking, planning
  - Time mgt., initiative
- Interpersonal
  - Communication
  - Teamwork, leadership
- Business
  - Customer
  - Marketing

Recent Education = CDIO

Integration

Comprehensive Learning: KIT

Disciplinary Knowledge

- Science & math
- Physics
- Thermodynamics
- Statics & dynamics
- Discipline specific
  - Aero
  - ME
  - EE
  - Civil
  - Chemical
  - etc.
- Humanity electives

Ningen-ryoku

Existing Education

Gaku-ryoku
CLIP: Comprehensive Learning Initiative Process

Upward Spiral Circuit in CLIP-Learning Process

Progress in Comprehensive Abilities

Comprehensive growth & progress

Eagerness towards Learning

Team Activity

Collaboration Leadership

Think

1. Knowledge Acquisition

2. Thinking, Deducing & Creating

3. Proceeding to next higher step

4. Presentation Communication

Communicate

Think

Presentation Communication
How should we implement the CLIP learning process for the comprehensive abilities?

Strive for Comprehensive Abilities

Implement CLIP Learning Process

Active Learning

Comprehensive Learning-type Class
Engineering Education at KIT

Active Learning

>>>Introduce to all classes!

“Active Learning”
of Each class, Each subject,
and Each teacher

For Example: for KIT program

Practice on innovative development of human resources through community-based educational reforms
4. Practice on Innovative Development of Human Resources through Community-Based Educational Reforms

2013 MEXT: Center of Community Project
MEXT (Ministry of Education, Culture, Sports, Science and Technology in JAPAN)
With regional partnership, we aim to promote human resources development in cooperation with local governments, residents, and industries.
Features in Education & Research Practice

Class-work Research + Extracurricular activities

Process of problem finding & solving based on issues in real world

Local Government Residents + Enterprises

Local Community
COC: Center of Community
Community-based Education & Research Projects at KIT

Merging of Education, Research and Social contribution as professor’s primary tasks

Education/Research Project
Social Contribution Project
Cooperation of teachers, staffs, businesses and local residents

Enhancement of opportunity for project-based learning
Opportunity for Practical Learning

Community-based education
Comprehensive learning-type class
Achievement of active learning

Active Campus/Education & Research Environment
The geospatial information project provides an opportunity for local community to study advanced technologies. Geospatial technology is utilized in various fields such as car navigation systems, map services, surveying, and monitoring services for children and the elderly.
KIT has made a cooperative agreement with Kanazawa Medical University to address immediate problems of disease treatment. We also partner with businesses in the field of medical engineering.
This project contributes to community development on the basis of a cooperative agreement with important stakeholders in the local communities of Kanazawa City and Nonoichi City. This is an extremely beneficial experience for students studying architecture.
5. Concluding Remarks
The direction of KIT engineering education program fits the context of CDIO-Initiative.

- Curriculum with project based design education as its main pillar
- Many workspaces, such as the Factory for Dreams & Ideas
- Active learning based on the CLIP-learning process
- Promotion of integrated learning activities based on community-related projects, which make regional contributions and provide students and teachers with an opportunity to be motivated and reflected

By participating in the CDIO-Initiative which indicates an international standard engineering education program, KIT strives to expose the strengths and weakness of the KIT education program and formulate specific remedial measures from a global viewpoint with the goal of enhancing engineering education.
Thank you for your attention!