

# APAIE 2024



PERTH, AUSTRALIA 4-8 MARCH 2024

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*Collaborating for sustainable impact: partnerships across the Asia Pacific*

APAIE Perth 4 - 8 March 2024



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Session 15D: Thurs 7<sup>th</sup> March, 11:15 – 11:45

## **Developing Industry-ready Graduates through Techno-Social Problem-Solving Programs**

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### **Chair**

Maria Anytiasari  
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# Developing Industry-ready Graduates through Techno-Social Problem-Solving Programs

Session 15D  
Thursday, Mar 7, 2024  
11:15 - 11:45

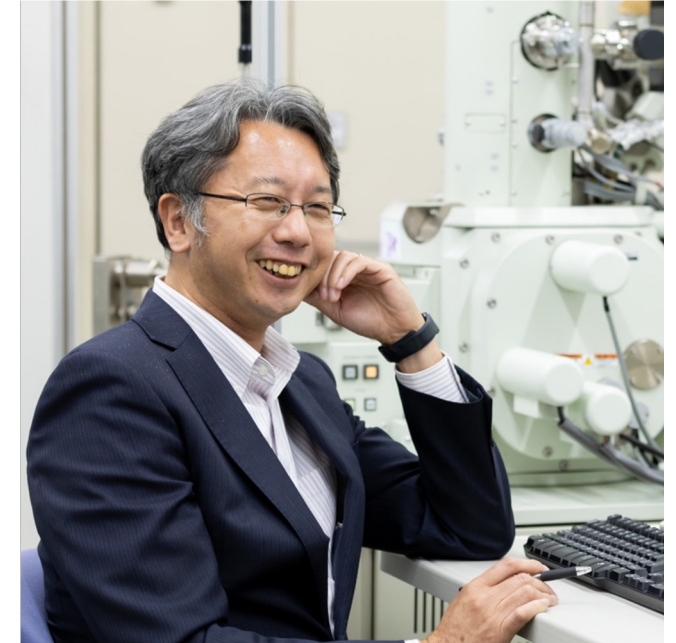
# 1. Self-Introductions



**Hiro Ishizaki**  
Visiting Professor  
Shibaura Institute of  
Technology  
Japan



**Assoc Prof.  
Dr. Maria Anityasari**  
Director of ITS Global  
Engagement, Institut  
Teknologi Sepuluh  
Nopember (ITS) Indonesia



**Prof. Dr. Ken Judai**  
Professor, Department of  
Physics  
Nihon University  
Japan

## 2. Learning Objectives

- Demonstrating the outcomes of this **Techno-Social Problem-Solving Program**
  - (1) methods for **developing practical skills** for research activities and industrial practices,
  - (2) how to **simulate real world working conditions**, and
  - (3) **hidden benefits of industrial side** to assist university programs as “teaching is learning”,
- Discussing **how to design effective PBL curriculum** by elaborating technological knowledge and soft skills,
- Sharing **teaching instruments such** as That’s What I learnt (TWIL) to streamline students’ learning and discussion process.

# 3. Problem Statement

- 1) What skills are essential for future engineers?
- 2) What/how to provide them with learning opportunities?
- 3) How to evaluate their outcomes?

# 4. Outline of Techno-social gPBL

Objective: To developing industry-ready graduates

## Settings

Technologies from industry

Social issues from municipalities

## Contents & Methodology/Tools

Part1:  
Online briefings

Part 2:  
Onsite Field Research

Part 3:  
Group work & presentations

Tool: TWIL

# 5. Industry-ready Graduate & Engineering Curriculum

*“How to develop Washington Accord 11 Graduate Attribute Profile”*

## *Washington Accord Graduate Attribute Profile*

1. Engineering Knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Investigation
5. Tool usage
6. The Engineer and the World
7. Ethics
8. Individual and Collaborative Teamwork
9. Communication
10. Project Management and Finance
11. Lifelong Learning



# 6. Expectations from Industries

## *IHI Asia Pacific Pte Ltd.*

### 1. Initial objectives to support this gPBL series

- To strengthen collaboration with university & government stakeholders\
- To understand social challenges in Surabaya and Indonesia's general
- To introduce IHI and IHI solutions' engineering capabilities

### 2. Expectations to this program

- 1) Technological aspects: how to apply to the local content
- 2) Relationship development: existing and new
- 3) HR development: to support industry-ready graduates  
(future employees, counterparts, or researchers)

### 3. Outcomes from this series

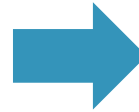
- Short-term goals are achieved.
- Internal benefits

### 4. Next actions

- How to convert these short-term outcomes to long-term goals.

# 7. Expectations from Surabaya City Government

The government expects the GPBL program to **address key social issues** related to renewable energy and waste management as one of the **major concerns** in Surabaya's city planning. The importance lies in recognizing **the interdependence of these stakeholders** in addressing complex challenges effectively.



Through combined efforts, the GPBL program aims to **develop innovative solutions and initiatives** that tackle social issues effectively. This collaboration **enhances community resilience, promotes sustainable development, and fosters a culture of environmental responsibility** in Surabaya and beyond.

# 8. gPBL Approach: Learning through Social Issues

The GPBL program integrates project-based learning with guest lectures, site visits, group discussions, and discussions with industry experts and government, offering a **comprehensive educational experience** which emphasizes:

- **Cross-Cultural Collaboration:** Students from Indonesia and Japan collaborate in diverse teams, fostering cross-cultural understanding, sharpening their English communication skills which essential for global engagement.
- **Experiential Learning:** The program prioritizes experiential learning, allowing students to apply theoretical knowledge to real-world scenarios. By engaging in hands-on activities, students gain practical insights and develop problem-solving abilities beyond traditional classroom settings.
- **STEM Real-World Learning Opportunities:** Emphasizing immersive experiences, the program encourages students to explore real-world environments through site visits and interactions with industry practitioners and government.

# 8. gPBL Approach: Learning through Social Issues



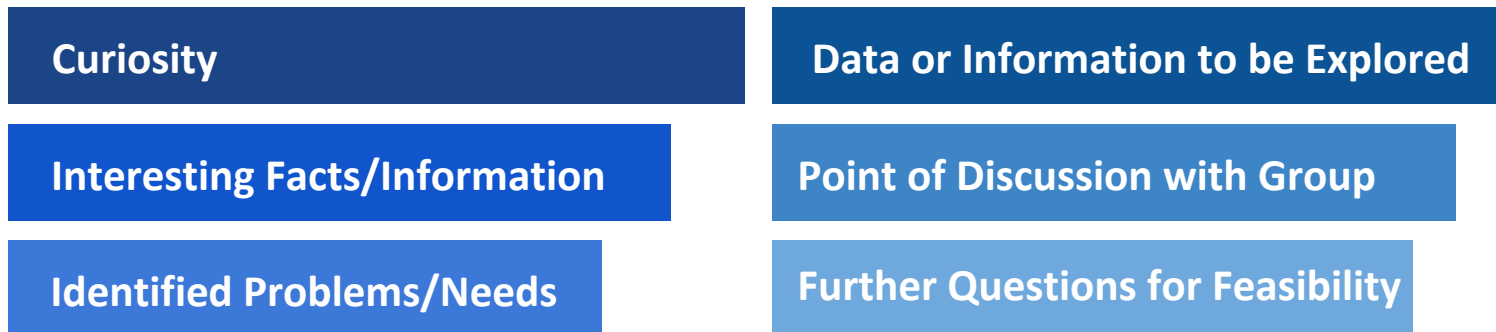
Picture 1. Site visits and presentation from industries in GPBL program.

# 9. Instruction Design

After each session of the online and offline program, students are required to complete the "That's What I Learnt" (TWIL) **worksheet**, facilitating individual and group reflection.

This instructional design integrates a **multidisciplinary approach**, blending diverse fields to address complex problems. These integrated strategies aim to cultivate industry-ready graduates capable of navigating diverse challenges and analysis.

**That's What I Learnt (TWIL) key queries:**



**Global Project-based Learning**

**GROUP TWIL – THAT’S WHAT I LEARNT**

|  |  |  |
|--|--|--|
| Group: D2  |  |  |
| Day & Date: Wednesday, 06-09-2023                              |  |  |
| Topic: Opening Ceremony & Talkshow with Surabaya City Councils |  |  |

|  |   |   |
|--|---|---|
| <b>Curiosity</b><br><small>(Fill in before you listen to the presentation of the speakers)</small> <ul style="list-style-type: none"> <li>Is there any new information added to this session with Surabaya compared to last week's meeting?</li> </ul> | <b>Interesting Facts or Information</b><br><small>(Fill in during the presentation of the speakers)</small> <ul style="list-style-type: none"> <li>The emission Trend that is being displayed is a bit misleading as it is the data from pandemic.</li> <li>They monitor more than CO2 emission ((PM10 and PM2.5), carbon monoxide (CO), nitrogen dioxide (NO2) sulfur</li> </ul> | <b>Identified Problems or Needs</b> <ul style="list-style-type: none"> <li>The need for the Surabaya Monitoring system to be more accurate, citywide, more informative and updated.</li> <li>The need for a more advanced automatic system for SITS, be it for monitoring (especially to categorize vehicle and behavioral pattern) or decision making, and a more seamless integration with supporting departments and authorities to regulate traffic.</li> </ul> |
|--|---|---|

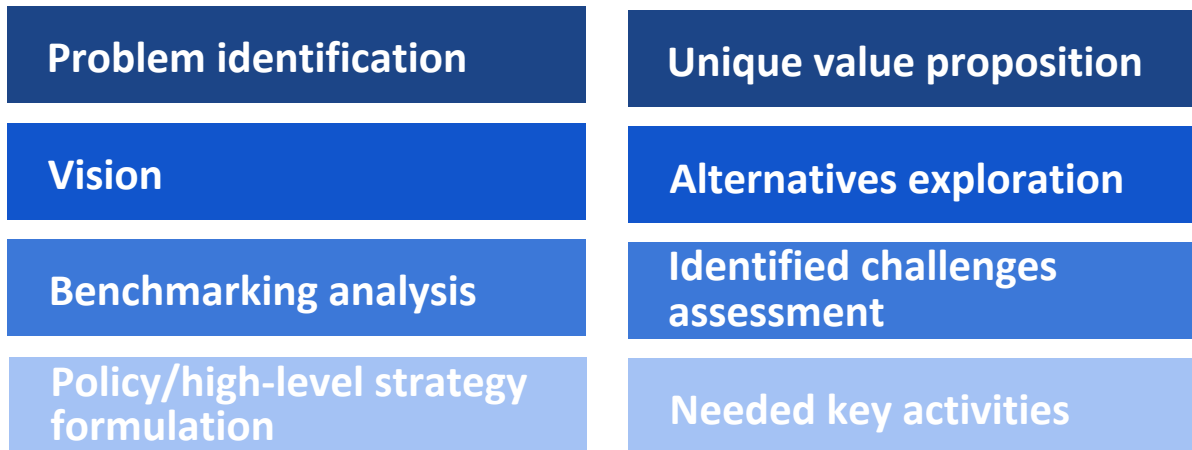
|   |  |
|---|--|
| <b>Data or Information to be Further Explored</b><br><small>(Fill in during or after the presentation of the speakers – before you discuss with your group mates)</small> <ul style="list-style-type: none"> <li>What the government has done with the maintenance of the feeder drain and the problem with the road-drain combination. When last week's presentation the water department complained about the pushback from the people about the expansion of the drain, would placing the drain directly under the road be better?</li> <li>Subsidise the solar power and export the energy to make a return on investment.</li> </ul> |  |
|---|--|

|   |   |
|---|---|
| <b>Points of Discussion with Group Members</b><br><small>(Fill in after the presentation of the speakers)</small> <ul style="list-style-type: none"> <li>Surabaya needs an integrated waste sorting and compaction plant to improve waste efficiency. Instead of focusing solely on societal change, it may be more effective to implement sorting at the final processing stage, potentially alongside educational policies and providing separate bins to households.</li> <li>Implementing an early warning system for CO2 in "RED AREAS" through cell phone detection and network towers could enhance safety and awareness among individuals working in these areas.</li> <li>Integrating weather and rain monitoring equipment at pumping stations is essential for predicting and responding to weather-related events, enabling informed decision-making and reducing risks.</li> </ul> | <b>Further Questions for the Feasibility Study</b><br><small>(Fill in after the presentation of the speakers)</small> <ul style="list-style-type: none"> <li>What technology does all this department want and the specification for the equipment they need?</li> <li>Why don't we use Nuclear?</li> </ul> |
|---|---|

Picture 2. Example of TWIL Worksheet.

# 9. Instruction Design

On the first year of GPBL, each groups are required to submit a **Group Discussion Canvas (GDC)** in the end of the program. The GDC adapted from the Business Model Canvas, incorporates queries including:



These components culminate in a **comprehensive submission at the program's conclusion**, fostering strategic thinking and collaborative problem-solving among participants.

**GDC – GROUP DISCUSSION CANVAS**  
 Group: B3 Day & Date: Saturday, November 6th 2021  
 Case: Smart Urban Mobility, Online Transportation System

|   |   |  |   |
|---|---|--|---|
| <b>PROBLEM</b><br><ul style="list-style-type: none"> <li>Traffic Jam</li> <li>A lot of private transportation</li> <li>Efficiency public transportation</li> </ul>      | <b>VISION</b><br><ul style="list-style-type: none"> <li>Let people in Surabaya like to use public transportation.</li> <li>Improving the public transportation system.</li> </ul> | <b>BENCHMARKING</b><br><ul style="list-style-type: none"> <li>Monorail in Japan</li> <li>Public facilities for walkers</li> <li>Rail track for bikers</li> </ul>   | <b>UNIQUE VALUE PROPOSITION</b><br><ul style="list-style-type: none"> <li>Provide effective option for citizen</li> <li>Minimize emission in Surabaya</li> </ul>      |
| <b>AFFECTED STAKEHOLDERS</b><br><ul style="list-style-type: none"> <li>Transportation Bureau</li> <li>Local Government</li> <li>Local resident</li> </ul>               | <b>EXISTING ALTERNATIVES</b><br><ul style="list-style-type: none"> <li>Surabaya Bus</li> <li>Online Transportation (Car and Motorbike)</li> </ul>                                 | <b>SOLUTION ALTERNATIVES</b><br><ul style="list-style-type: none"> <li>Combination between Train and Walkers track</li> <li>Monorail that can used both side</li> <li>Connected monorail station and common</li> </ul> | <b>IDENTIFIED CHALLENGES</b><br><ul style="list-style-type: none"> <li>Expensive cost</li> <li>Long time to establish the transportation system</li> </ul>            |
| <b>KEY ACTIVITIES REQUIRED</b><br><ul style="list-style-type: none"> <li>Establish Train and Walkers track</li> <li>Provide easier payment methods for train</li> </ul> | <b>POLICY OR HIGH-LEVEL CONCEPTS REQUIRED</b><br><ul style="list-style-type: none"> <li>Rules of Use Private Transportation, especially for students and workers</li> </ul>       | <b>COST STRUCTURE</b><br><ul style="list-style-type: none"> <li>Advancing the plastic payment method</li> <li>Provide variety types of E-money method</li> </ul>   | <b>REVENUE OR BENEFIT STRUCTURE</b><br><ul style="list-style-type: none"> <li>Minimize plastic waste</li> <li>Support the utilize of public transportation</li> </ul> |
| <b>KEY SUCCESS FACTORS</b><br><ul style="list-style-type: none"> <li>Punctually Operation</li> <li>Unification of transportation</li> <li>Easy of riding</li> </ul>     |   | <b>IMPLEMENTATION STRATEGY</b><br><ul style="list-style-type: none"> <li>Socialization by promoting public transportation by public figure</li> <li>Special price for students</li> </ul>                              |   |

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Picture 3. Example of Group Discussion Canvas.

# 9. Instruction Design

However, starting in 2023, we believe that students should focus more on addressing the **unique challenges** of each topic, which may not fit neatly into the predefined sections of the GDC.


Therefore, we have introduced **challenge statements** as mandatory points for students to address. These statements prompt students to **delve deeper** into the specific obstacles and complexities of each topic, fostering critical thinking and problem-solving skills essential.

**Data Utilization**




**CO2 Data Monitoring and Utilization**

1. Comment on the CO2 data capturing carried out by Surabaya City Government. Do you think that it is adequate, accurate and reliable? Compare the data capturing technology by other countries. Suggest the better technology, analyze the benefits and cost consequences of investing the better technology in Indonesia context.
2. Comment on how CO2 data can be processed and utilized for wider and more useful decision making.
3. Comment on how mobility and transportation data can be linked to the CO2 data capturing.
4. Suggest a better system for Surabaya City CO2 data monitoring. You may add alert system to prevent bad air pollution that happens in Jakarta for example. Your system may include the location of CO2 data capturing, faster even real time analysis and feedback system, system to automatically convert the data to be information and decision making input.




Picture 4. Example of Challenges Statements.

**Clean Energy and Biomass**



**Waste to Energy from Commercial Businesses**

1. Comment on the current strategy and ecosystem for waste to energy from commercial businesses carried out by Surabaya City Government. Compare the practices with better practices in other countries.
2. Suggest on how to increase the energy generated from waste to energy from commercial businesses.
3. Suggest on how to estimate the energy generated from commercial businesses waste in the next 10-20 years. Use robust methods to do the estimation.
4. Suggest better policies, strategies, technologies, and system. Analyze the benefits and cost consequences of investing better strategies, technologies, and system in Indonesia context.



Picture 5. Example of Challenges Statements.

# 10. Final Presentation

## Scoring Indicators

During the final presentation, students are required to **present their analysis and their innovative solutions** to address the identified problem and showcasing their **survey findings in 10 minutes**.

Reviewers consist of representatives from ITS and SIT lecturers IHI experts, and representatives from Surabaya City Councils. The best 3 groups are selected based on the recap of scoring indicators which includes:

| Sharp problem identification   | Quality of proposed solution               |                                       |  | Quality of the content   | Presentation Delivery  |
|--|--|---------------------------------------|--|--|--|
| Clearly identifying and analyzing critical problems that need to be solved | Proposing creative and innovative solution | Creating data/evidence-based solution | Having socio-economic consideration for the solution | Accommodating accurate & clear information for each aspect in the challenges statement | Having each member of the group delivering a clear and concise information during presentation |
| 20%  | 15%  | 15%                                   | 15%  | 20%  | 15%  |

Picture 6. Final presentation scoring indicators.

## Feedback from Reviewers

The feedback indicates positive aspects such as **thorough analysis and consistent recommendations aligned with challenge statements**. However, concerns were raised regarding data comparison across cities, especially the benchmark to Japanese cities.

The presentations were commended for streamlined delivery and information extraction from field research, yet there was a **call for more comprehensive consideration on strategies improvement, cost and feasibility assessments**.

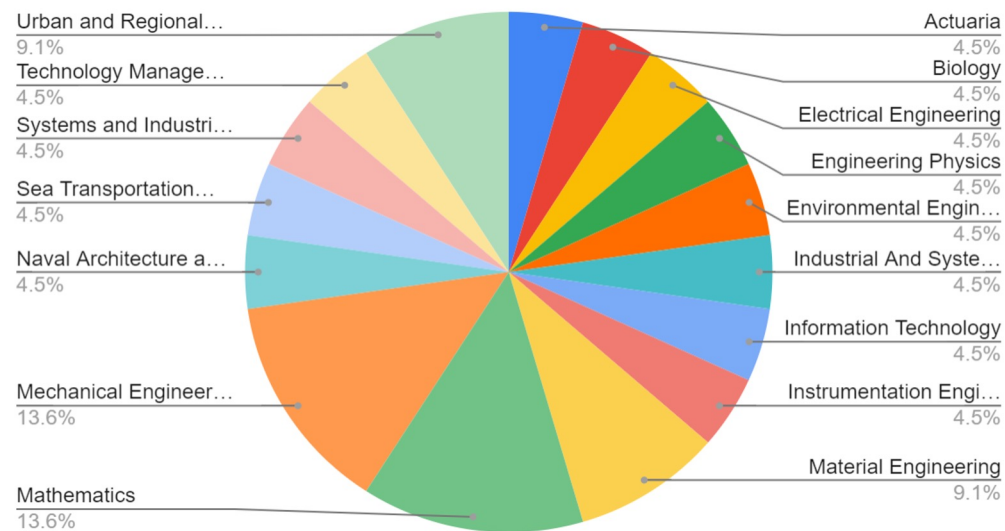


# 11. Analysis of outcomes (1) : overall

## Portfolio from ITS students.

Reflecting on the entirety of this project-based learning experience spanning 10 days, comprising 7 offline and 3 online, several key considerations come to mind. I initially entered this endeavor with certain expectations, but what I understood and experienced far exceeded them. The project immersed me in diverse perspectives, global collaboration, and hands-on learning, providing insights and skills that go beyond what I typically encounter in my regular university studies. It was a refreshing departure from the traditional classroom setting, offering a dynamic and real-world context.

## ITS Students' Study Backgrounds

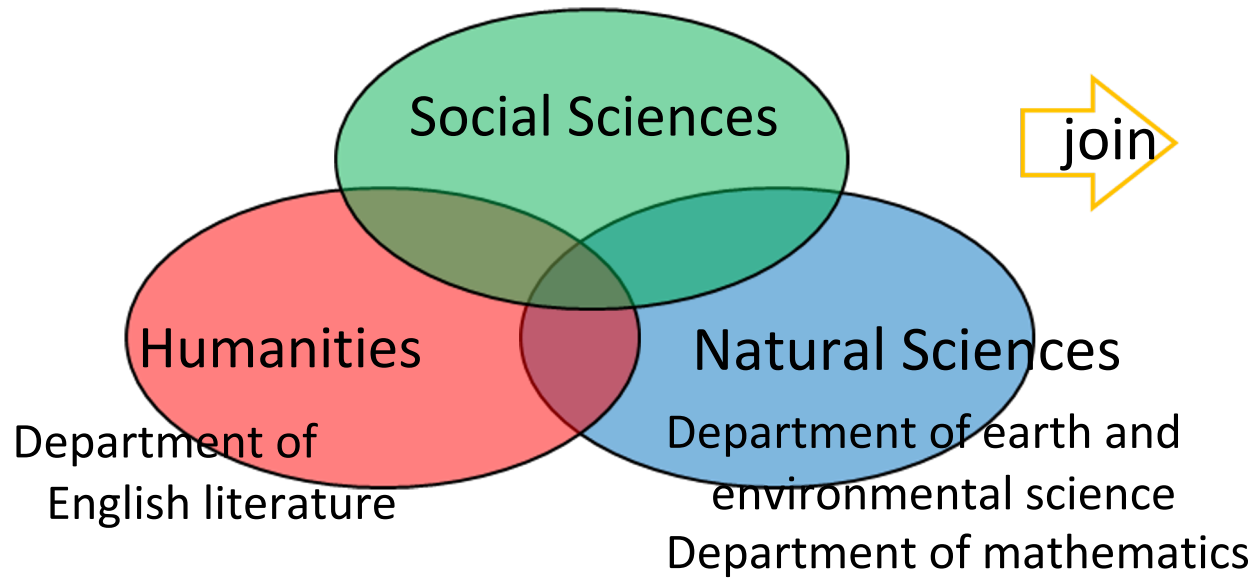


ITS students for the program came from multidisciplinary background. All of them **reflect positively** on their GPBL experiences and highlights the immersive and insightful journey that exceeded initial expectations.

They also appreciate their friendship with Japanese students as they can delve into Japanese culture, traditions, and daily life, while also sharing their own customs and perspectives. Shared interests bridge cultural gaps, fostering deeper connections and mutual understanding. Beyond cultural exchange, these friendships **promote empathy, adaptability, and global awareness.**

# 11. Analysis of outcomes (2): Japanese participants

Nihon University, College of Humanities and Sciences      Engineering college



Shibaura Institute of Technology  
Sepuluh Nopember Institute of Technology

Environmental issue

**Humanities students needed to be supported in discussing environmental issues.**

A science student commented that his knowledge of CCUS (Carbon dioxide Capture, Utilization and Storage) was useful for the program, but some students found the terminology difficult.

# 11. Analysis of outcomes (2): Japanese participants

Online meetings →



Factory tour



Group meetings



Final presentation

The program is well designed for understanding.

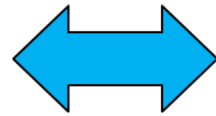
Japanese students were grateful for the hospitality of Indonesians.

The Japanese students could not hear English and repeatedly asked to the Indonesian students, and they politely and gently explained technological points also. The student mentality of the partner universities is considered important in terms of continuous program.

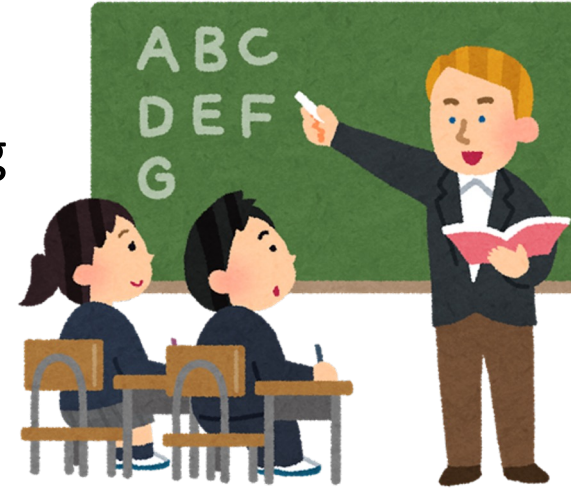


# 12. Key findings

This program  
Global PBL



Language training  
on school trip



They commented that this program was **much more effective** for them in improving their English than the language study trip. Both programs lasted about 2 weeks, but they had to discuss with their peers for the final presentation, and they had to prepare presentation materials as homework after returning to their hotels. The language learning program must have been very different from this program, which has **a clear goal and landing point**.



The in-depth interactions with their peers not only provided discussions for the presentations but also made the Japanese realize the cultural differences. Regarding Muslim prayers, many students were surprised by the practice and accepted it.

# 13. Next Actions & Proposals

- ITS, SIT, IHI, NU planned to continue the efforts for another Global Project-based Learning in 2024. Plans include **online and onsite meetings**, to create a more well prepared, flexible, accessible, and engaging educational programs. ITS also planned to work with **Research Center** of ITS.
- The program targets each 25 Japanese and ITS students, aiming for **40% graduate student participation**, as their participation is hoped to elevates the overall academic discourse and facilitates deeper exploration of complex topics.
- The program continues to address key priorities aligned with the Surabaya City Government's agenda, including **CO2 and water level monitoring, transportation systems, and waste-to-energy** initiatives. Additionally, new ideas proposed by IHI have surfaced, expanding the scope to include:
  1. Urban infrastructure-increasing real estate values
  2. Energy system and transition
  3. Water management
  4. Sustainable forest management

# 14. Conclusion & Discussions

## *[Conclusion]*

- Techno-Social Problem-Solving Programs are effective methods for educating future global engineers.
- Industry sides are willing to assist educational institute for developing future employees/customers.
- Structured instruction design is essential for engineering skills.

# 14. Conclusion & Discussions

*[Discussion]*

- 1) What skills are essential for future engineers?
- 2) What/how to provide them with learning opportunities?
- 3) How to evaluate their outcomes?

# 15. Post-session survey



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