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Annual Report of Asia & ASEAN Center for Educational Research

Spring 2023,Vol.3 No.1

Asia & ASEAN Center for Educational Research
Faculty of Education, Chiba University

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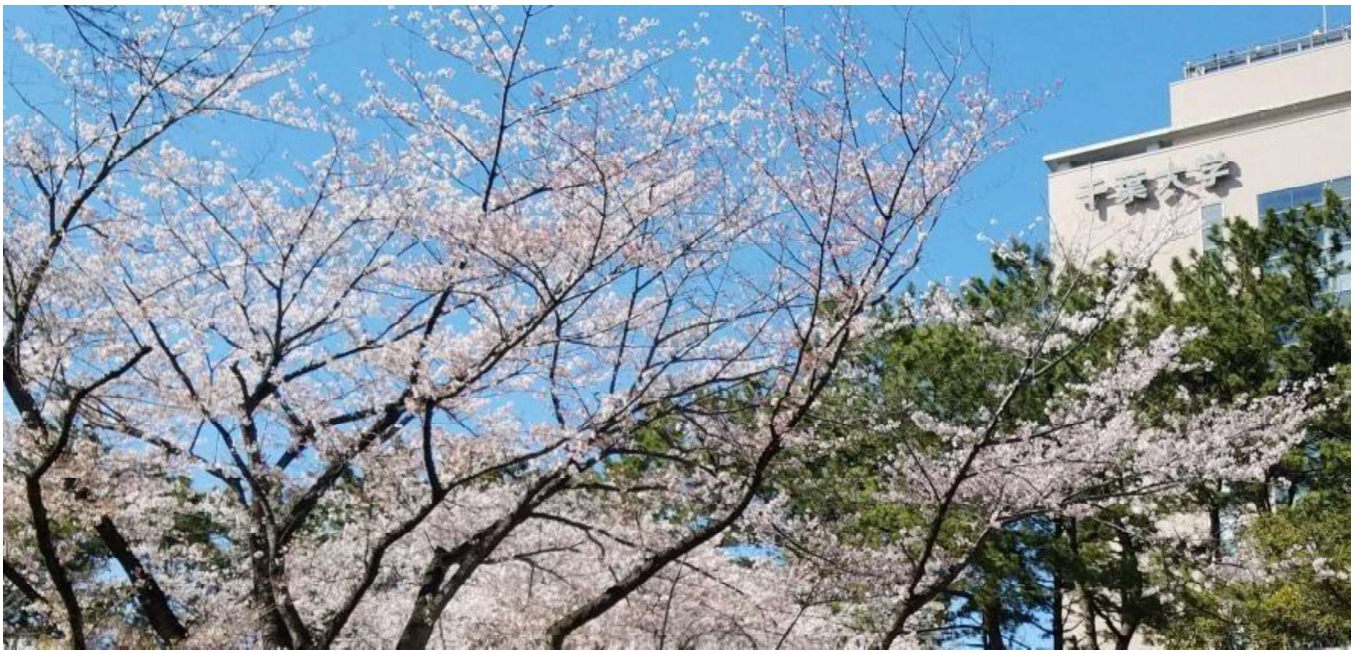
CHIBA UNIVERSITY

The Annual Meeting of Asia & ASEAN Center for Educational Research with Spring Institute

- SDGs education at universities -



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Asia & ASEAN Center for Educational Research

Annual Meeting Asia & ASEAN Center for Educational Research
“SDGs Education at Universities”

Edited by
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Advancing the Society 5.0 by Coordination of ENGINE
Talent Promoting Program : AP

“International Research Session”
“SDGs Work Shop”

Edited by
Advancing the Society5.0 by Coordination of ENGINE Talent Promoting Program : AP Program

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This is supported by Chiba University Open Recruitment for International Exchange Program.

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Greeting

Jun Nomura

Director Asian & ASEAN center for Educational Research , Professor, Graduate school of Science Chiba University

AACER has continued to interact online with our partner universities during the three years of the Corona pandemic with great success. Because the corona pandemic had not calmed down, the AACER exchange meeting for the first semester of this year was again held online. On the other hand, we were able to hold our annual face-to-face meeting in the second half of the year. It was a great pleasure to see so many collaborators from our partner universities and renew old friendships after a three-year absence.

We implemented three notable initiatives for the current fiscal year.

(1) Conducting online SDGs workshops with the support of the JST Sakura Science Program.

In this program, we introduced a newly developed online tour in addition to the laboratory visits, and we also conducted this as a joint program for high school, undergraduate, and graduate students.

(2) Exchange of knowledge on SDGs education conducted by each university

SDGs education is a very important initiative for building a sustainable society in the future. There are some differences in matters that should be addressed in each country, and these differences should be resolved from a global perspective. Therefore, it is expected that the exchange of information and discussion regarding these efforts at this annual meeting will be a step towards new collaborative education and research in the future.

(3) On-site and online hybrid implementation of the International Research Meeting

The international research meeting was held online only in the summer session. However, in the spring, it was possible to conduct a hybrid implementation in the form of transmitting this situation mainly on-site. As a result, not only Japanese high school students but also participants from all over the world, mainly from ASEAN countries, were able to learn various things about science together.

In the next fiscal year, we would like to resume practical exchanges as we have been doing so far and create a new form of exchange suitable for Society 5.0 that incorporates the online exchange methods developed during the COVID-19 crisis.

We ask for the warm support of all the collaborating researchers in the future.

International Research Session

Purpose of the Research Session

To find crucial topics related to the development and sustainability of the world is an excellent ability of the leaders of the next era. Likewise, communicating those critical topics to other young people in the intellectual community will empower the young people. Therefore, this International Research meeting aims at providing a platform for fostering the next-generation of leaders in the fields of science and education.
In this meeting, presenters will show their achievements in science and educational activities. Please find the advance of scientific findings, and exchange knowledge and friendship at the meeting site.

We hope every presenter find positive suggestions and solutions for the progress of their researches.

【 Schedule 】

09:30-10:00	**Reception**	
10:05-10:25	**Opening Remarks** Professor Makoto Watanabe, Director of Chiba University, Japan Professor Kenichi Oto, Faculty of Science, Head of Next-generation outstanding learning support office, Chiba University, Japan Hijiri Kaneko, Chiba Prefectural Board of Education Yasuo Katsube, Chiba City Board of Education	
10:30-11:45	**Oral Presentation 1** (Room 2109,2112,2201,2202,2203,2204,2205)	2109 2112 2201 2202 2203 2204 2205
11:45-11:55	**Break**	
11:55-13:10	**Oral Presentation 2** (Room 2109,2112,2201,2202,2203,2204,2205)	

Members

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Chair Person	IDA KANIAWATI	Universitas Pendidikan Indonesia
Assistants	TOCH PHEAKDEY	Royal University of Phnom penh
Assistants	KITTTA Mikiko	Chiba University
Assistants	FURUKAWA Ayu	Chiba University
Judge	IVONNE MILICHRISTI RADJAWANE	Institut Teknologi Bundung
Judge	KANYASAN KETHSANA	National University of Laos
Judge	Borba Gâmbaro Cláudia Maria	Chiba University
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Presenter2	Yadav Valdes Rajan Tsukuba Shuei High School **"Pronunciation Improvement Program for High School Students"**	
Presenter3	TANAKA Shiori Shibaura Institute of Technology Kashiwa Senior High School **"The Evaluation of Military Intervention Validity done by the USA"**	
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Presenter7	SUDO Moeka, MATSUNO Miyu, YAGI Momoko, SEKINE Aika, KITAGAWA Sakura Chiba Prefectural Kokubun High School **"Support for the Ukraine crisis "**	
Presenter8	KOJIMA Ichigo, YAHASHI Waka, OHASHI Fukunosuke Shibaura Institute of Technology Kashiwa Senior High School **"People's awareness of garbage problem and its reduction"**	

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Chair Person	NIRAMITCHAINONT POSCHANAN	Mahidol University
Assistants	CHANSAENGSEE SOVARITTHON	Mahidol University
Assistants	TASHIRO Honoka	Chiba University
Judge	LEKSANSERN ARISARA	Mahidol University
Judge	KETSING JEERAWAN	Kasetsart University
Judge	Hafiz Anshari	Chiba University
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Presenter2	ODA Miyou, NAKA Nanako Reitaku High School **"What I have learned in ELA"**	
Presenter3	NISHIKAWA Manaka, KATAOKA Kanna Ichihara Chuo High School **"2022 ESD Activity Report"**	
Presenter4	AMANO Haruto Azabu Junior High School **"Learning in the Debate Course of the ASCENT Program"**	
Presenter5	TAKIUE Fuki Shibuya Kyoiku Gakuen Shibuya Senior High School **" Disparity During the Pandemic"**	
Presenter6	DANG MINH TUAN, NGUYEN DUC NGUYEN VNU University of Education **"Fostering teaching competency in STEM education for natural science students at VNU University of Education in Vietnam"**	
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Presenter8	SUWA Hannah, SUZUKI Maya, BOYAMA Kaho, UEDA Haruma, SUNAGA Elisa Chiba Prefectural Matusdo Kokusai High School **"Matsukoku Revolution～Matsukoku can change the world～"**	
Presenter9	MOCHIZUKI Kaho Ichikawa gakuen Ichikawa Senior High School **" What I Learned from Logical Analysis Classes"**	
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Chair Person	KOOLSRIROJ UDOMLUK	Kasetsart University
Assistants	RUPAVIJETRA PHETCHAREE	Chiang Mai University
Assistants	TRAN THI THU HUONG	VNU University of Education
Assistants	MORISHIGE Hina	Chiba University
Judge	YEH YI-FEN	National Taiwan Normal University
Judge	NGUYEN DUC HUY	VNU University of Education
Judge	Brenes Leon Mariana	Chiba University
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Presenter2	FEBBY AYU FITRIANI Universitas Pendidikan Indonesia **"The analysis of science teachers' needs for ESD-based teaching materials on climate change topics"**	
Presenter3	MOCHIZUKI Kaho, SASAKI Nene Ichikawa Gakuen Ichikawa High School **"Gender Eqality"**	
Presenter4	SHISHIDO Tomoka Keio Girls Senior High School **"Relationship Between Self-Control and Emotions in High School Students Studying for Exams"**	
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Presenter7	NGUYEN TUNG LAM VNU University, Hanoi **"Open Education Resources (OER) in pre-service teacher training programs toward Sustainable Development Goal 4 (SDG 4)"**	
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Presenter9	ITO Yuika, OTSUKI Yuto Shumei Yachiyo High School **"Families and siblings of persons with disabilities"**	
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Assistants	JUGAR RICHARD RAMOS	University of San Carlos
Assistants	KUBO Mihiro	Chiba University
Judge	ASSAVARAK PASSANAN	King Mongkut's University of Technology Thonburi
Judge	AGUS BUONO	IPB University
Judge	MATSUMOTO Ryoji	Chiba University
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Presenter3	MULYADI ALWI Universitas Gadjah Mada **"Geospatial analysis of sea level rise in small islands, Karimunjawa, Indonesia"**	
Presenter4	KIKUCHI Takeyoshi, TATEISHI Kaisei, AKEZUMA Naohiro Chiba Prefectural Chiba Technical High School **"Research and Development Biomimetic Soft robot arm "B-sora""**	
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Chair Person	KARINA APRILIA SUJATMIKO	Institut Teknologi Bundung
Assistants	TAREELAP NAPACHAT	King Mongkut's University of Technology Thonburi
Assistants	CHINEN Rin	Chiba University
Judge	BOON-ON PATSORN	Silpakorn University
Judge	TAGALOG RITA MAY PATINO	University of San Carlos
Judge	Carvalho Silva Iago	Chiba University
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Presenter2	MOROKAWA Yuna Senshu University Matsudo High School **"Comparative Impact of Solar Power Generation on Local Ambient Temperature in Different Environmental Models"**	
Presenter3	YABUNOUCHI Hiroki, SEKI Tomoaki Chiba Prefectural Kisarazu High School **"Make foreign rice into Japanese sushi rice"**	
Presenter4	SAITO Yushin Chiba Prefectural Sakura High School **"Deodorizing Effect by Acidic Solution"**	
Presenter5	PHAT KOREA Royal University of Phnom penh **"Oxides and Activated Carbon on Removal of Arsenic from Cambodian Well Water"**	
Presenter6	NAKANO Kotaro Chiba Prefectural Chiba Higashi High School **"Trying to recreate the confection 'NERUNERUNERUNE'"**	
Presenter7	OTUKA Asuka, KATO Miyu Chiba Prefectural Yakuendai High School "How to dye cloths with gentian ? "	
Presenter8	ARAI Miyuu, KOSHIO Yui Tokyo Metropolitan High School of Science and Technology **"Influence and Effect of Additives on Pyrolysis of Unutilized Wood Resourcess"**	
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Assistants	JAENGAKSORN NATTHAPOL	Chiang Mai University
Assistants	KATO Chiharu	University of Tokyo
Assistants	GOTO Akari	Chiba University
Judge	SANTIPARP PRASAK	Mahidol University
Judge	NI KOMANG ARI SAWITRI	Udayana University
Judge	Siti Nurul Zhahara	Chiba University
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Presenter2	NAGAO Tomo Keio Chutobu Junior High School **"The Effects of Grape Seed Extract on Interleukin-12 and Prostaglandin 2 Production in Mouse Dendritic Cells"**	
Presenter3	KANAZAWA Anna Showa Gakuin Shuei High School **"Current status and Issues of wall greening"**	
Presenter4	TANAKA Yuna Chiba Meitoku High School **"Development of a genetic identification method for the flower types that make up honey"**	
Presenter5	KAJIWARA Kent Tokyo Gakugei University Internationl Secondary School **"Evaluation of antibacterial effects of catechin lysozyme mixtures against Streptococcus mutans"**	
Presenter6	FUNAKI Yayoi Crimson Global Academy **"Recovery from Cognitive Fatigue by Aerobic Exercise"**	
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Chair Person	KITCHAROENPANYA JARUPA	Chulalongkorn University
Assistants	BAMBANG SULISTYANTARA	IPB University
Assistants	YOSHIMOTO Kanako	Chiba University
Assistants	TANIGUCHI Akari	Chiba University
Judge	DYAH RAHMAWATI HIZBARON	Universitas Gadjah Mada
Judge	Peter Nkachukwu Chukwurah	Chiba University
Judge	Joceline Theda Kadarman	Chiba University
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Presenter5	OISHI Miyu, HIRATA Chie, NAKANO Eko Tokyo Metropolitan High School of Science and Technology **"What Can be Seen Through Bird Droppings"**	
Presenter6	ISHIKAWA Mayu Tokyo Metropolitan High School of Science and Technology **"Genetic variation of wild radish and its cultivated landraces"**	
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Proceedings

（High School Students）

People's awareness of garbage problem and its reduction

Phuong Anh[1], Gia Huy, Han[1], Kojima Ichigo[2], Yahashi Waka[2], Ohashi Fukunosuke[2]

1.FPT High School, Vietnam
2.Shibaura Institute of Technology Kashiwa Senior High School, Japan

Purpose and Background

Today, a number of regions and people are confronted with garbage problems, including Vietnam and Japan. Uncountable pieces of trash in the ocean, large amounts of single-use plastics in our daily life, and polluted water where organisms are dying. Thanks to our development, we spend comfortable and abundant life while the environment has been destroyed. Now, it must be time we restore it. This is why we have studied on garbage problem. We have been to Vietnam as a part of our study, focused on awareness of the garbage problem and its deduction among people, and compared Vietnamese and Japanese ones. Also, we wish to thank Vietnamese group members and all who helped us with our research.

Materials and methods

In this research, we took a survey of both Vietnamese and Japanese high school students, analyzed the data, and considered the garbage problem. We had developed the survey questionnaire by "Google Forms". Most of the questions are "choice questionnaires' ' which are about everyday life and garbage problems, and also regarding its awareness. Here are some examples of the questions below.

"How many plastic products do you use on a weekly basis?" "How do you feel about wearing clothes that were used by someone?" "What do you do to reduce household's waste in your daily life?"

Thanks to both FPT and SIT schools, we could have 547 survey respondents.

Result and discussion

Firstly, we surveyed the number of plastic products that people use on a daily basis. This result shows that Vietnamese students tend to use less plastic than Japanese students, and we considered that this is because of the difference in the number of "water servers" in each school. We think that our school's students have a lot more chances to buy plastic bottles, which causes more plastic waste, but Vietnamese students don't. Setting up water servers is a very good way to reducing plastic waste in school.

Secondly, we also surveyed clothes and "organic cotton", which is friendly to the environment. In the results, most Vietnamese students have heard of organic cotton, while Japanese students do not. Also, we asked "what do you do with the clothes that you don't use anymore?". As a result, most Vietnamese students answered they give someone, while half of the Japanese students answered throwing them away. We consider this is because of the GDP gap between Vietnam and Japan, which is shown in the table below. Japanese GDP is 8 times higher than Vietnamese one, and we considered it is natural for Vietnamese people to reusing clothes by giving them to someone.

Our final focus is on this question, "what do people do to reduce waste?". Through analyzing this data, we are aware of the difference in eco-friendly education. Japanese students learn what to do to reduce environmental problems, while most Vietnamese students don't learn how. We wish that wherever students are, they should have a chance to learn and think about environmental problems and solutions to reduce the problems.

Even though culture, values, national character, and so on are different between Japan and Vietnam, we cannot simply compare and judge the differences in results. However, we believe that there is a lot to learn from Vietnamese people. And we hope we can work together to make a better world.

GDP per capita of each country

	2019	2020	2021	2022
VN	3,398	3,514	3,718	4,163
TH	7,813	7,159	7.232	7,631
PH	3,512	3,326	3,576	3,598
JP	40,566	39,981	39,301	34,358

8 times

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About Recycle Paper

Hannah Lee, Miku Kamasuka and Saho Oshita

Shibuya Kyoiku Gakuen Makuhari Senior High School, Japan

Purpose and Background

We chose to recycle paper because it provides three important benefits. First, recycling paper is easy. Second, it solves the problem of over usage of paper in our school. Third, recycling paper is impactful. On average our school uses 12 thousand yen for paper in a day. We think that by cutting down on paper consumption, we can save the amount of money that our school uses. Moreover, we can prevent further trees from being cut down by recycling paper.

Materials and Methods

To recycle paper, we first collected scratch paper from our school. Then, we used a blender to blend the paper into a pulp. We made a frame by using picture frames and used it to scoop the pulp. We placed the pulp on a piece of cloth and let it dry for several days. After a few days, the paper was dry and ready to use.

Results and Discussion

We were able to provide three significant changes after doing this activity. Firstly, we were able to conserve the amount of energy we used. Since we used around 360 sheets of paper in a year, we were able to save up 8 kilowatts of energy and 14 gallons of water according research conducted by the Connecticut Department of Energy and Environmental Protection. Secondly, we calculated that were able to save up to 0.025 trees in a year. Thirdly, we were able to encourage technology use. For example, because one teacher stopped giving out 1 weekly paper handout for all his classes, he saved 8100 sheets/year which equates to saving approximately 6800 yen. So, if 10 teachers stopped giving out 1 weekly paper handout for their classes, they would be able to save in a year, about 15 percent of the amount of paper used, and 2 percent of the amount of money spent on paper.

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Fun Tidbits About Recycling, Energy and Climate Change. https://portal.ct.gov/

THE STARTING POINT FOR RESEARCHERS IS HERE

Hayato Morita

Tokyo Gagugei University International Secondary Shool, Japan

Purpose and Background

I acquired proficiency in the Python programming language through the ASCENT Program's eight-class curriculum at Chiba University. The program not only provided me with a solid understanding of the basics of advanced science and technology, but also proved to be an invaluable experience. The ASCENT Program holds immense significance as it offers high school students the opportunity to experience a college-level course.

What is Python

Python, a programming language that has become incredibly popular, has a more recent history compared to other languages, having been developed in 1991. The language's large standard library, which provides a wealth of appropriate tools for a wide range of tasks, has contributed to its extensive use across various fields.

Course Description

The course (figure 1.) covered fundamental concepts like functional and object-oriented programming, and virus libraries. We also explored machine learning and its application in advanced science using Python. Weekly assignments were given to create algorithms for numerical processing. There was a challenging open data analysis assignment that enhanced my coding skills and comprehension of the subject matter.

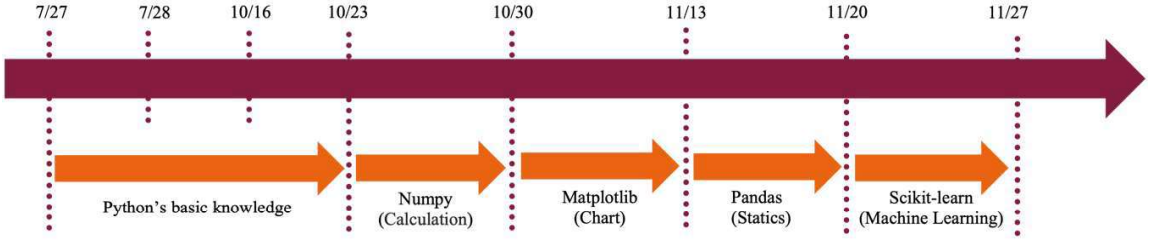

Figure 1. Course Content

Kind of benefits for society may come from coding

The impact of coding on society and its benefits cannot be ignored. Web and application development are some of the situations where coding has improved people's standard of living. The further development of programming could lead to even more benefits for society, such as "crime forecasting". Neil Shah, Nandish Bhagat, and Manan Shah (2021) propose a theory that uses machine learning algorithms and computer vision to predict crimes. Criminals are increasingly taking advantage of technology. They describe existing techniques for identifying criminals are inadequate and many criminal cases share common criminal motives. Machine learning can enable predicting crimes based on statistics by identifying their similarities through classification.

Significant for high school students to learn coding

Learning coding in high school allows students to actively use science and technology. In universities, coding is usually taught in a passive way through lectures. Unfortunately, many high school students who are interested in advanced technology do not have opportunities to explore it. But if they learn coding from experts like those in the ASCENT Program, they can actively conduct experiments and verifications using coding. This can lead to more advanced research in university. A personal project on data analysis using GoogleEarthEngine last year helped me take a more proactive approach to problem-solving.

Significant for high school students to practice English

English practice is essential for high school students especially for those hopeful to become researchers. The ability to read and write papers and give presentations in English is crucial for success in this field. However, many high school students lack opportunities to practice speaking English, which can hinder effective communication with foreign researchers. The English lessons provided by foreign students in the ASCENT program were a valuable opportunity to improve critical thinking and communication skills in English.

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What I learned from ASCENT program's landscape design course

Riku Fujii

Osaka Prefectural Suito Kokusai Senior High School, Japan

Purpose and background

I was interested in how memorials and monuments remain in one's memory, even though the monument itself was built a long time ago. Therefore I decided to find out what exactly makes a memorable monument.

Materials and Methods

I attempted to find the properties that make a memorable monument, by analyzing two memorials that are famous throughout the world.

Results and Discussion

The memorials that I analyzed were the atomic bomb dome in Hiroshima (Fig. 1) and the 9/11 memorial in America (Fig. 2). One common point that I found between the two memorials, is that they both have the original landscape (architecture) remaining. The atomic bomb dome still has the original building partly remaining, and the 9/11 memorial is in the exact place where the destroyed building was at, and also the architecture has the exact same size. Secondly, I believe that the 9/11 memorial is memorable because it is a part of people's daily life. The memorial is now connected to a nearby park, and a lot of local people enjoy having a walk in there.

Fig. 1: The Atomic bomb dome in Hiroshima

Fig. 2: The 9/11 memorial in USA

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Resersh and development biomimetic soft robot arm B-sola

KIKUCHi Takeyoshi, TATEISHI Kaisei, AKEZUMA Naohiro

Chiba Technical High School, Japan

Purpose and Background

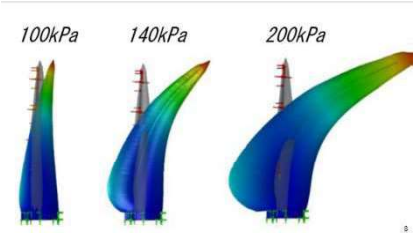
We wanted to conduct research and development of industrial robots that are safe even when humans and robots come into contact. That's when we turned our attention to soft robotics. Soft robotics is engineering that deals with robots that use soft materials such as silicon. We decided to research and develop a soft robot that bio mimics the arm of an octopus. The goal is to develop a biomimetic soft robot arm that can adapt to different shapes and tasks, and to make it simple, low cost and lightweight. The purpose is to verify how it works and to show its functional significance based on it.

Materials and Methods

We arranged seventeen suction cups in a staggered manner along the robotic arm. Next, we used 3D-CAD to create the formwork. For B-sora, silicon with low shrinkage during curing and high dimensional stability was used. A tube was screwed into the hole in the molded formwork in the arm section. The required amount of silicon and hardener was calculated, placed in the same container, evenly mixed, and the mixed silicon was poured into the molding formwork. Then, after curing, it is demolded. Attach the molded formwork of the suction cup to the arm silicone. Next, repeat the same process as on the arm. After curing demolded and cut off the excess tube exposed from the suction cup. We designed and fabricated pneumatic circuits to control compressed air and vacuum. The metal 3D printer used fills the inside of the machine with nitrogen, fires a laser beam at the metal powder material, and burns it for additive manufacturing. The advantages of using a metal 3D printer are that it is possible to design a free shape, and the cost performance is good.

$$z_j = \begin{cases} L - \frac{5R_0(L)\cos\frac{\alpha}{2}}{4} & j = 1 \\ L + \frac{R_0(L)\cos\frac{\alpha}{2}}{100}j^2 - \frac{17R_0(L)\cos\frac{\alpha}{2}}{25}j - \frac{29R_0(L)\cos\frac{\alpha}{2}}{50} & j = 2,3,\ldots,17 \end{cases}$$

$$x_j = R_{tip} + z_j \tan\frac{\alpha}{2} + \frac{9R_0(L)}{25\cos\frac{\alpha}{2}} - \frac{3R_0(L)}{200\cos\frac{\alpha}{2}}j,$$



Results and Discussion

We prepared a sample of how the robot arm grasps an irregular shape and verified it by actually operating it. With a mass of 775g, it is much lighter than a mechanical robotic arm and can be freely transported anywhere.

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Verification of Desalination Effect Using Synthetic Hydrotalcite

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Purpose and Background

It is estimated that there are approximately 1.4 billion km3 of water resources on the globe, most of which, 97%, is seawater. The amount of freshwater available for human use is a meager 0.01% of the total water resources. Currently, the world's freshwater use is 70% for irrigation, 23% for industrial use, and 7% for domestic use. Declining water resources are a major cause of soil desertification and environmental problems, and an increasing number of regions are unable to secure water resources. As a result, desalination technology, which obtains usable freshwater from abundant seawater, is attracting attention. The conventional desalination technologies for seawater include the multi-stage flash evaporation method and the reverse osmosis membrane method, but these technologies are intended for industrial and domestic use, where high purity freshwater is required, and are expensive for irrigation (agricultural use), where the freshwater utilization rate is the highest. Seawater contains elements such as K and Mg, which are nutrients for crops, but it also contains NaCl, which causes salt damage. If the concentration of NaCl can be reduced, the possibility of converting seawater to agricultural water can be created. Currently, the world population is approximately 7.7 billion, but it is expected to reach 9.7 billion in the next 30 years. The world's growing population is threatening a food crisis, and it is easy to imagine that there will be competition for water. Therefore, there is an urgent need to establish low-cost seawater desalination technology. There have been reports of desalination of seawater using molecular sieves, but this study will use hydrotalcite, which has an anion adsorption effect.

Materials and Methods

In this study, hydrotalcite with anion adsorption capacity was used as an additive to verify its desalination properties. Artificial seawater with a specific gravity of 1.023 was prepared and used as a reagent. In Experiment 1, hydrotalcite was added to artificial seawater for 2, 4, 6, and 10 days, and the amount of chloride ions adsorbed was analyzed. In addition, radish sprouts and garden radish seeds were planted in each of these liquids soaked in a non-fat cotton cloth and stored in the dark.

Results and Discussion

Adsorption decreased after 10 days of shaking. Chloride ions may have re-eluted. Desalinated seawater with hydrotalcite may allow plants to germinate (Fig.1).

Fig. 1(a) Tap water through HT (b) Seawater, 1 in 10 dilution (c) Seawater

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Evaluation of antimicrobial activity of liposome-encapsulated plant derived metal nanoparticles

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Purpose and Background:

Antibiotic resistance in bacterias is one of the world's leading problems. As researchers around the world constantly come up with new antibiotics to keep up with the rate of antibiotic resistance developed in bacteria, many researchers have looked at other antimicrobial methods to fight bacterias. One such method, nanoparticles (NPs) have piqued the interest of many researchers due to their flexibility and potential in advancing many fields. Metal NPs in particular have shown efficacy as potent antimicrobial agents. Although they are useful in many fields, they often have negative environmental impacts hence the research to be conducted will be utilizing green leaves of poisonous plants to make the silver metal NPs. Poisonous plants are not widely researched and using green plants helps produce a more environmentally friendly alternative which is affordable and can be produced in large amounts. Furthermore, by encapsulating the silver metal NPs in a lipid membrane called liposomes have shown to reduce the toxicity of the metal NPs to body cells which increases its versatility, making it possible for the liposome encapsulated green silver metal NPs a potential method of antimicrobial treatment in organisms.

Materials and Methods:

The research method can be divided into 3 main parts; the production of silver metal NPs, encapsulation of the NPs with liposomes and the antimicrobial testing and characterizations of these particles. Firstly, plant extracts are obtained from a poisonous plant with green leaves and this is dissolved and mixed with a solution of silver nitrate. Chemicals in the plant extract will reduce the silver nitrate to form silver NPs which will then be characterized by the following methods; UV-spectral analysis, Scanning Electron microscopy analysis (SEM) and Dynamite scatter analysis (DLS). The antimicrobial properties of the metal NPs will then be tested with *E.coli*. The metal NPs will then be encapsulated in liposomes using a thin lipid film and the liposome encapsulated silver NPs will again be characterized under similar methods as previously described but will use a light microscope rather than a SEM due to its size. Finally, the particles will be tested for its antimicrobial activity again using *E.coli*.

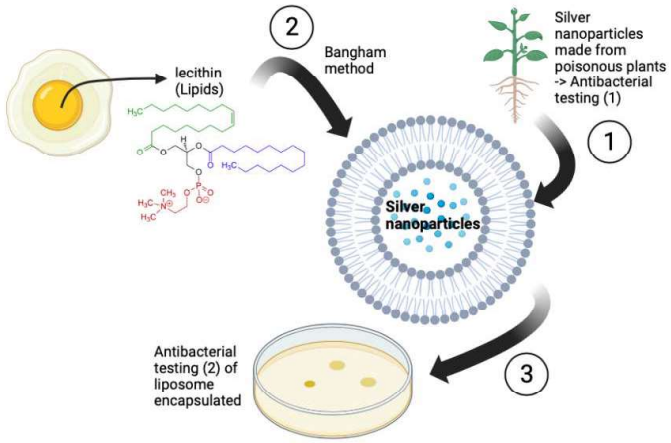

Figure 1: Summary of methodology used to produce the particles

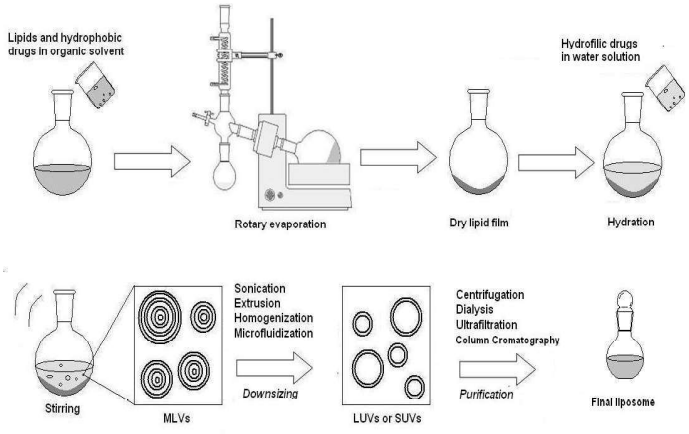

Figure 2: Outline of the Bangham method, a frequently used method for encapsulation of substances in liposomes. (Andra, et al. 2022)

Results and Discussion

The research is to be conducted in the future.

References

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Development of 3d graphics cognitive therapy using self-objectification

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Purpose and Background

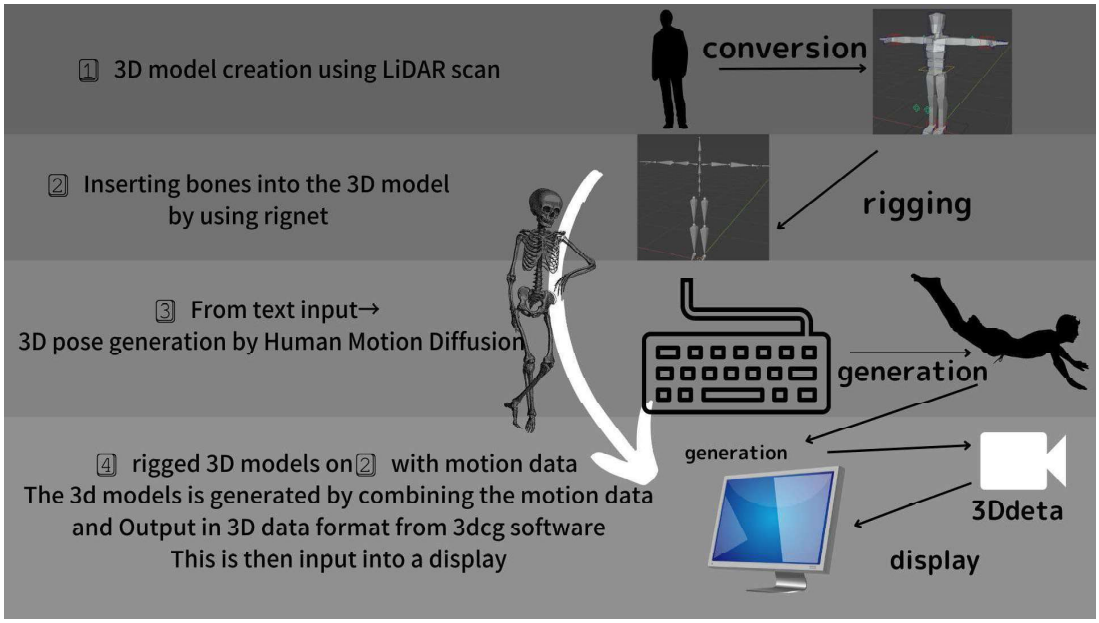
The cognitive therapy approach assumes that cognitive distortions are the cause of anxiety disorders. In exposure therapy, a method within cognitive therapy used to treat anxiety disorders and other disorders, the patient's trauma is processed appropriately in the brain by using reality or virtual space, and the patient's disease condition is alleviated by becoming accustomed to it. In this study, we will focus on exposure therapy, which is called "image exposure therapy," in which the patient is exposed to the cause of the trauma by imagining it. This study will devise a new image exposure method.

Materials and Methods

In recent years, thanks to the rapid progress in 3D graphics and machine learning technologies, it has become possible to automatically generate precise 3D models and motion data. In this study, a LiDAR scanner attached to a smartphone is used to generate a 3D model of the same face and body shape as the patient, and the motion of the patient during trauma is generated and shown to the patient to promote self-objectification, which mean the patient recognize them as a mere object. This new method is expected to enhance the patient's image exposure by facilitating the patient's information processing and making it easier for the patient to visualize the trauma.

Result and Discussion

Although this method is expected to be more effective than the conventional image exposure, it can be inferred that it will have a negative effect when used on depressed patients, since excessive self-objectification is considered a cause of depression and other disorders. In addition, although there are studies on emotional changes caused by viewing 3D models of oneself, detailed studies on the degree of influence on the increase of self-objectification by viewing 3D models of oneself have not yet been conducted, and therefore, clinical trials are needed to confirm the safety of this method before its practical use. Clinical trials are needed to confirm the safety of the product before it can be put into practical use.



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Modeling traffic jam with marbles

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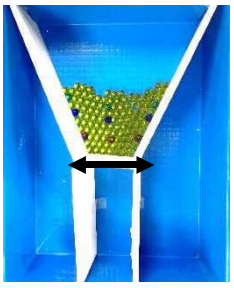
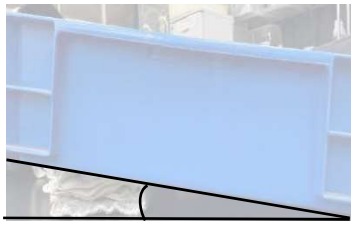
Purpose and Background

There are two main types of traffic jams. One is bottleneck-type jams, which are caused by narrowing widths, and the others is sag jams, which occur when people don't realize they are on a gradual uphill slope and their speed decreases. I began this research because I wondered how things and people behave when these traffic jams are occurring. The purposes are (1) Model a traffic jam with marbles and check whether the principle of traffic jam is valid in the model. (2) Investigate the movement of marbles when there is a traffic jam. (3) Investigate new ways to solve traffic congestion.

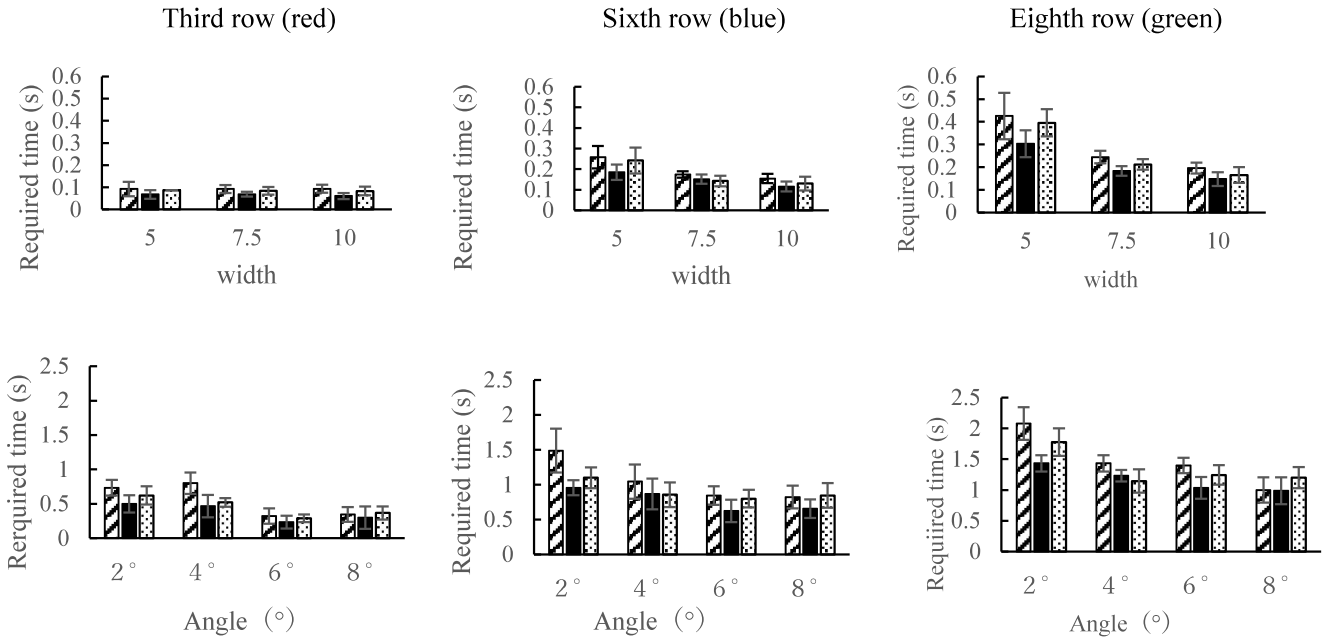
Materials and Methods

I measured the time required for the red, blue, and green marbles to pass through the arrowed area The longer it takes, the more crowded the traffic is. I checked how much the crowding would change if I changed the width and slope of the experimental setup.





Results and Discussion



(i) The narrower the width, the more congested the traffic jam was.
(ii) The smaller the slope, the more congested the road was in the 2° - 6° range.
(iii) In the 6° - 8° range, the degree of congestion did not change.

Consider these results …

(i) The narrower width simply meant that there were fewer marbles that could get out, so the traffic was congested.
(ii) (iii) If the slope was small, the speed was slow and the marbles jammed, resulting in a traffic jam.
If the slope was too large, the traffic jam was caused by the collision with the marbles in front.

Influence and Effect of Additives in Polyethylene Recycling

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Purpose and Background

Since plastics can be used in a wide range of fields, demand for plastics is increasing worldwide and production has been increasing for many years. On the other hand, much of the plastic waste used is landfilled or dumped into the ocean, causing many environmental problems such as marine issues. In addition, fossil fuels, the raw material for plastics, are a limited non-renewable energy source, so recycling them is essential for their continued use. Therefore, technologies to convert plastics back to oil, the raw material, are attracting attention, especially in the EU countries, where pyrolysis technology, a chemical recycling process, is attracting attention. Japan's polyethylene production accounts for 35% of total production, but only 5% of total production is unutilized resource. Recycling by pyrolysis is an effective way to utilize polyethylene.

Materials and Methods: TIMES NEW ROMAN, 11 POINTS BOLD

We previously reported that "the addition of hydrotalcite allows efficient pyrolysis and gasification". It is known that the properties of hydrotalcite, which is an additive, vary depending on its composition. In this study, we will examine the influence and effect of adding hydrotalcite with different composition ratios(Table.1). The general formula for hydrotalcite (HT) is $Mg_{1-X}Al_X(OH)_2(CO_3)_{X/2} \cdot mH_2O$, which is an aluminum-magnesium hydroxide complex(Fig.1). The recovered gases were evaluated as energy by qualitative and quantitative analysis. In this study, we focused on CH_4.

Table1. Differences in composition

Substance	KW-1000	KW-2000	KW-2200
Al_2O_3	19.3%	33.4%	34.9%
MgO	35.1%	61.0%	59.9%

KW-1000:synthetic hydrotalcite of Mg/Al_2=4.5
KW-2000,KW-2200:KW-1000 calcined to eliminate interlayer water, interlayer anions and hydroxy groups coordinated to Mg and Al

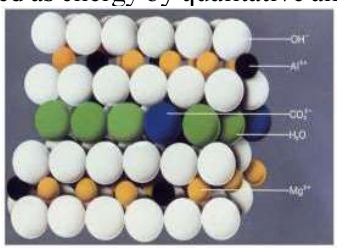

Fig.1 Structure of hydrotalcite (Photo by Cetrus Holdings)

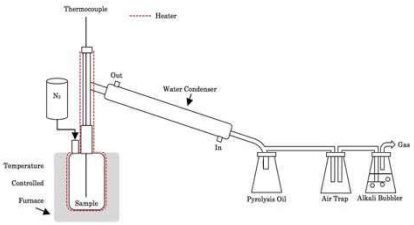

Fig2. Experimental Apparatus

A predetermined amount of HT was added to 20g of polyethylene(Fig.2). The sample is placed in a metal reactor, and nitrogen is replaced for 60 minutes. Measure the sample portion of the reactor as decomposition temperature using a thermocouple (550°C in 70 min) After reaching 550°C, keep warm for 30 minutes.

Results and Discussion

Polyethylene virgin material (Asahi Kasei) is pyrolyzed using synthetic hydrotalcite as an additive(Table2). The yield , gas production and substances produced will discussed.

Table2. Experimental Conditions

Conditions	Sample	Addition
I	PE	
II	PE+KW-1000	2 : 1
III	PE+KW-2000	2 : 1
IV	PE+KW-2200	2 : 1

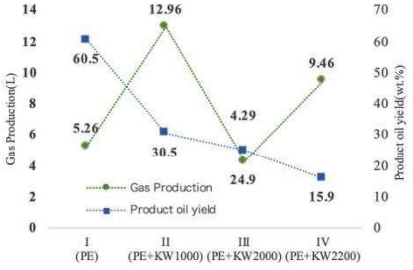

Fig.3 Gas production and produced oil

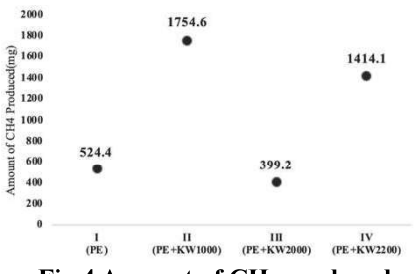

Fig.4 Amount of CH_4 produced

It can be inferred that the different compositions of HT affect the pyrolysis(Fig.3).The three types of HT have different volumes due to differences in composition(Fig4), suggesting that there is an optimal amount of HT to be added.

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Comparative Impact of Solar Power Generation on Local Ambient Temperature in Different Environmental Models

Yuna Morokawa

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Purpose and background

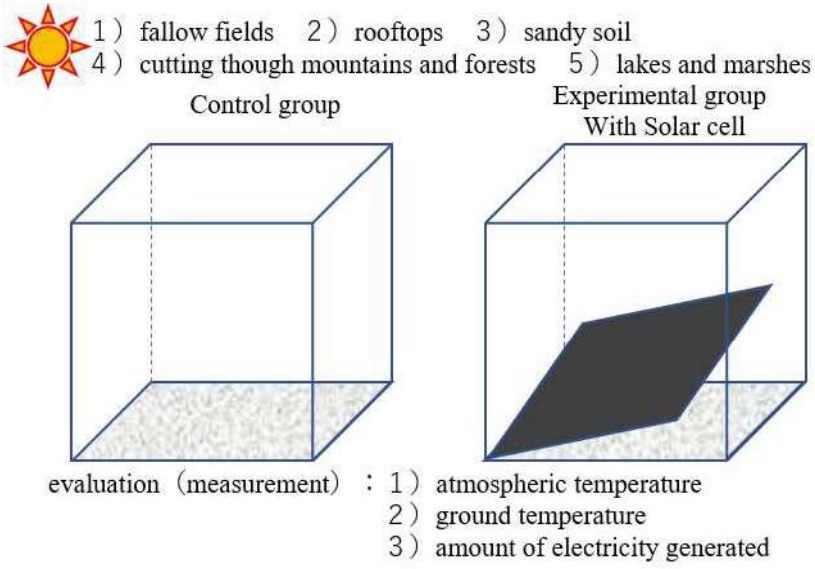
Solar power is generated by collecting energy from the sun on the earth. Global warming, on the other hand, is caused by the accumulation of heat on the earth. And this heat energy is also derived from the sun. These facts led me to question whether solar power is really a solution to global warming and how much benefit solar has compared to the difference in CO_2 emission rates between fossil fuel power generation and energy collection. Accordingly, in this study, we aim to evaluate the impact of solar power generation on ambient temperature in five environmental models.

Materials and Methods

The experimental method is based on a scale model. First, two glass cases are prepared for each object. One is a reproduction of the assumed terrain environment, and the other has solar panels installed in the assumed terrain environment. The five topographic sites are: a fallow field, a rooftop, a sandy soil, cutting through mountains and forests, and lakes and marshes. Both will be placed in the sun. The temperature of each ground and atmospheric temperature will be recorded at 7:00 in the morning and at 19:00 at night. We will also measure the energy and the amount of electricity generated. Furthermore, we will compare the CO_2 emission rate with that of fossil fuel power generation, and consider the gains and losses of solar power generation versus fossil fuel power generation. This will allow us to evaluate the impact of solar power on ambient temperatures and determine how beneficial solar power can be.

Results and Discussion

My hypothesis is that we will observe a local temperature increase due to solar panels. Furthermore, fossil fuel power generation is greater than solar power generation. On the other hand, the global impact of CO_2 emissions is greater than the local temperature rising due to solar panels. In other words, photovoltaic power generation has the effect of reducing global warming. We intend to conduct experiments and observe the results.



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2,https://www.science.org/doi/10.1126/science.aar5629

MAKING FOREIGN RICE INTO JAPANESE SUSHI RICE

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Purpose and Background:

In 1993, Japan suffered from a rice shortage and imported Thai rice to remedy the situation. However, Japanese did not like Thai rice. Therefore, in order to bring the taste of Thai rice closer to that of Japanese rice and to offer an alternative to the Japanese people, the researchers made an attempt to turn foreign rice into Japanese rice. There are as many as 100,000 varieties of rice grown around the world. Of these, the researcher had chosen three of the most common rice, Thai, Indica, and Italian, and turned them into Japanese sushi rice.

Materials and Methods:

The following materials and instruments were used: 150g of each rice. 3 teaspoons of each seasoning. Sushi mold, Rice cooker, Moisture checker, and ruler. The procedures are as follows:

(1)After cooking the rice, divide rice into 15g portions,

(2)Add 3 teaspoons of seasonings,

(3)Mix the seasonings thoroughly,

(4)Put the rice in into the sushi mold,

(5)Ask the participants to rate the sushi rice using a survey.

Approximately 10 participants were asked to fill out a 5-point-scale survey based on how close they were to Japanese rice with 5.0 being highest and 1.0 being lowest. The researchers calculated the average of their evaluation, and the results will be discussed in the next section.

Results and Discussion

As shown in Table 1, Italian rice's average values in most categories are higher than the other rice, therefore it could be said that Italian rice is the most appropriate rice to be made closer to Japanese rice. Although Thai rice had an overall approximate average of "3" in each category, there is a crucial difference between Thai and Japanese rice and most participants find its texture and elasticity "different from that of Japanese". Like Indica rice, as the taste is considerably different and the rice grains wouldn't stick to each other, that makes Thai and Indica hard to be turned into Japanese rice. The researchers speculated that the reason why evaluation of soy sauce is generally higher than ponzu could be the fact that Japanese are accustomed to soy sauce. Overall, despite there being a huge difference depending on the type of rice, Italian rice can be an alternate substitute for Japanese rice.

Texture	Vinegar × soy sauce	Vinegar × ponzu
Thai rice	3.3	3.2
Indica rice	1.6	1.6
Italian rice	3.8	3.6

Elasticity	Vinegar × soy sauce	Vinegar × ponzu
Thai rice	3.4	3.1
Indica rice	1	1.1
Italian rice	3.1	2.7

Taste	Vinegar × soysauce	Vinegar × ponzu
Thai rice	3.5	3.3
Indica rice	2.1	1.8
Italian rice	3.9	3.2

Table 1. Ratings on how close the taste of the combinations are to those of Japanese sushi rice

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Trying to recreate the confection “Neruneruneruneruneru”

Nakano Kotaro

Chiba Prefectural Chiba Higashi High School, Japan

Purpose and background

Neruneruneruneruneru is the confection sold in Japan. There are three ingredients to make Neruneruneruneruneru Neruneruneruneruneru contains two powders and a topping. I was interested in Neruneruneruneruneru.
It turns out that this phenomenon is caused by a simple chemical reaction. Therefore, I decide to recreate Neruneruneruneruneru.

Analyses

I analyzed “Neruneruneruneruneru” in three ways. Focus on raw materials and nutrition facts label, neutralization titration, Check sugar content with a sugar meter.

Table. classification table

ingredient name	protein	fat	carbohydrate	calcium	respond to sugar meter
sugar	×	×	O	×	P
starch	×	×	O	×	I
albumen powder	O	×	×	×	P
citric acid	×	×	O	×	P
sodium icarbonate	×	×	×	×	P
polysaccharide thickener	×	×	O	×	P
calcium carbonate	×	×	×	O	I

O:Contains its ingredients
×:Contains only trace amounts of the ingredient or no ingredient at all
P: possible
I: impossible

I make this formula.

The amount of protein ≒ The amount of albumen powder
The amount of calcium ≒ The amount of Calcium Carbonate
The amount of all raw materials − The amount of raw materials that respond to sugar meter
= The amount of raw materials that doesn't respond to sugar meter,

I know the amount of calcium and protein by Nutrition facts label. So, I was able to know the amount of albumen powder and calcium carbonate.
I know the amount of all raw materials by nutrition facts label, and I know amount of Amount of raw materials that respond to sugar meter by sugar meter volume. So, I was able to know the amount of raw materials that doesn’t respond to sugar meter. The amount of raw materials that doesn’t respond to sugar meter equals the amount of starch and the amount of calcium carbonate. I know the amount of calcium carbonate. Therefore, I was able to know the amount of starch. I was able to know the amount of citric acid and sodium bicarbonate by Neutralization titration.

Reproduce

I could reproduce Neruneruneruneruneru. I diluted handmade Neruneruneruneruneru and Neruneruneruneruneru with ion exchanged water. Handmade Neruneruneruneruneru was getting cloudy. However, Neruneruneruneruneru was not getting cloudy and it is sinking.

fig1. Neruneruneruneruneru

Fig2. Handmade Neruneruneruneruneru

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Influence and Effect of Additives on Pyrolysis of Unutilized Wood Resources

Miyuu ARAI, Yui KOSHIO

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Purpose and Background

About 70 % of Japan‘s land area is forested. About 40 % of this was planted by people. Japan is one of the most forested countries in the world, but in recent years, there has been a growing concern about the devastation caused by unused and unmanaged forests. Sanmu city, Chiba Prefecture, produces a famous cedar called Sanbusugi, and has done so for 400 years. More than 85 % of the trees are affected by Sugi trunk rot caused by Fomitiporia sp, a type of white rot fungus. In 2019 Typhoon Faxai is caused extensive damage in Sanmu due to fallen Sanbu cedar. Due, in part, to the declining birthrate, aging population, and lack of resources, degraded forest areas are becoming more prominent. As a forest area located near the suburbs of a large city, it has an advantage over other forest areas because it`s easier to manage.

Materials and Methods

We previously reported that "the addition of hydrotalcite allows efficient pyrolysis and gasification". It is known that the properties of hydrotalcite, which is an additive, vary depending on its composition. In this study, we will examine the influence and effect of adding hydrotalcite with different composition ratios. The general formula for hydrotalcite (HT) is $Mg_{1-X}Al_X(OH)_2(CO_3)_{X/2} \cdot mH_2O$(Table1, Fig.1), which is an aluminum-magnesium hydroxide complex. The recovered gas was evaluated as energy by qualitative and quantitative analysis. In this study, a focus was placed on CH_4. 20 g of Sambu cedar, prescribed amount of hydrotalcite additive. The materials were mixed into the metal reactor for 60 minutes to create a nitrogen atmosphere. The temperature was raised to 450 °C at a rate of 5°C per minute. The generated gas was collected and a

Table 1 Differences in composition

Material	KW-1000	KW-2000
Al_2O_3	19.3%	33.4%
MgO	35.1%	61.0%

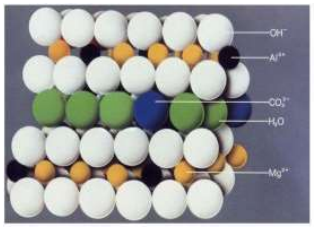

Fig.1 Structure of hydrotalcite

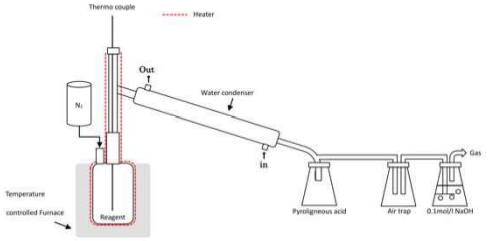

Fig.2 Experimental apparatus

Results and Discussion

(P

Table 2 Experimental conditions

Condition	Sample	Additive
I	Cedar	
II	Cedar + HT(KW-1000)	5g
III	Cedar + HT(KW-2000)	5g
IV	Cedar + NaOH	5g
V	Cedar + Sea sand	5g

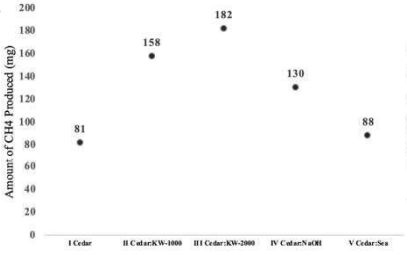

Fig.3 Amount of CH_4 produced

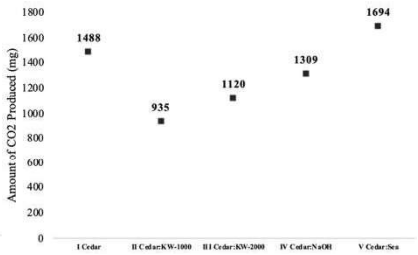

Fig.4 Amount of CO_2 produced

Although hydrotalcite of different compositions was added, both KW-1000 and KW-2000 increased the amount of CH4 produced(Fig.3). This is presumably due to the catalytic effect of the hydrotalcite, KW-2000 is more basic than KW-1000, and thus exhibited higher resolution. CO2 emissions can be set to zero from a carbon-neutral standpoint(Fig.4), but they were elevated by the addition of hydrotalcite. However, since the hydrotalcite used was hydrotalcite derived from seawater and the carbonic acid contained can also be derived from seawater, emissions are considered zero.

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[2] R. Hanazawa, K. Nakamura, H. Kawaraya, R. Shimizu, and N. Morita, "Effect of Additives on Gasification by Pyrolysis of Unused Cedar Wood", *International Journal of Chemical Engineering and Applications*, Vol. 13, No. 3, 2022.

Development of a genetic identification method for the flower types that make up honey

Yuna Tanaka

Chiba Meitoku High School, Japan

Purpose and Background

I like honey very much. Nowadays, I see honey that bear the names of specific plant flowers, such as apple honey, orange honey, and so on. However, for unlabeled honey, I was curious as to how to identify the different kinds of flowers from which such honey were made. In this research therefore, I used genetic means (DNA barcoding) to identify the floral make-up of unlabeled honey.

Materials and Methods

We isolated and observed pollen from a honey sample using a microscope. Each milligram of the honey sample contained about five pollens, so we used compaction to increase pollen amount. For compaction: 800 µL of distilled water and 200 µL of honey were mixed in a tube and centrifuged at 2000 rpm for 5 minutes. Then, 950 µL of the supernatant was removed. The same amount of distilled water and honey were added into the tube and centrifuged again. The compaction process was repeated several times until a sufficient volume was obtained. Microscopic pictures of different pollen types found in the honey were then taken. Thereafter, pollen DNA was extracted and PCR amplification of the internal transcribed spacer 2 (*ITS2*) regions carried out. The key PCR reagents used were: 2x KAPA HiFi Hot start R, 50 µM *ITS2F*-ADF, 50 µM *ITS2F*-ADR, distilled water. The PCR products were then subjected to agarose gel electrophoresis and documented. Sequencing of the PCR amplicon was contracted out o a commercial company afterwards.

Results and Discussion

Following microscopic observation of pollens, Figures 1a and 2a were obtained corresponding to pollens from *Swertia japonica* and *Medicago sativa* respectively. PCR amplification showed a single band (Figure 3) which was sequenced and analyzed further. DNA sequencing and further analysis identified *Swertia japonica* and *Medicago sativa* as sources of pollen DNA in the honey sample. Microscopic pollen images (Figs. 1a and 2a) looked very similar to those of reference plants (Figs 1b and 2b respectively) except for Ib which looked closer to *Centaurium tenuiflorum* than *Swertia japonica* although they both belong to Gentianaceae. We also thought that it would be possible, if only to some extent, to deduce the flowers from the microscopic pollen if only you knew the shapes of the many pollen forms.

Figure 1a. *Swertia japonica* (Microscope)

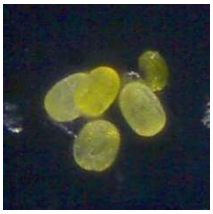

Figure 1b. *Centaurium tenuiflorum*[a]

Figure 2a. *Medicago sativa* (Microscope)

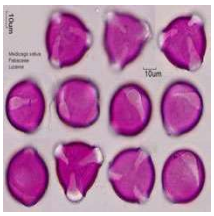

Figure 2b. *Medicago sativa*[b]

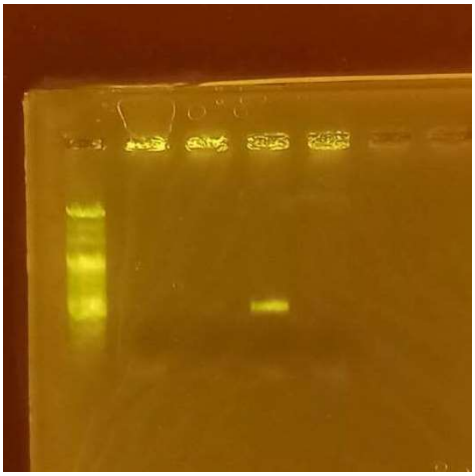

Figure 3. Gel electrophoresis showing single amplicon

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[a] https://matsue-hana.com/hana/hanahamasenburi.html

[b] https://pollen.tstebler.ch/MediaWiki/index.php?title=Medicago_sativa

Evaluation of the antibacterial activity of catechin-lysozyme mixtures against *Streptococcus mutans*

Kent Kajiwara

Tokyo Gakugei University International Secondary School, Japan

Purpose and Background

Dental caries is the most prevalent modern disease in the world. *Streptococcus mutans* has been reported to cause not only dental caries and plaque formation, but also to exacerbate infective endocarditis and enteritis. In this study, the antibacterial effect of a catechin-lysozyme mixture (CLC), which is a mixture of tea catechins and lysozyme (a bacteriolysis enzyme) was evaluated at a mixture ratio on *S. mutans* growth. Previous studies have shown the inhibitory effect of catechin and lysozyme on *S. mutans* (Iacono *et al.*,1980; Kawamura and Takeo,1989). Also, a strong antibacterial effect of 1:1 CLC against *E. coli, L. innocua, S. aureus*, and *S. cerevisiae* has been reported (Rawdkuen *et al.*, 2012). However, the effect of CLC on *S. mutans* was not evaluated, and no study has ever been done on varying mixing rates of CLC. Therefore, the study of CLC on *S. mutans* is valuable because it proposes a new method to improve the oral environment.

Materials and Methods

S. mutans was isolated from the researcher's oral plaque using Dent Cult SM and MSB selective agar medium and subjected to colony PCR. For the identification, the dextranase gene of *S. mutans* was targeted for amplification. (Igarashi *et.al.,*1996). The samples showed a band at 1.27kbp, which indicated that the samples were *S. mutans* (Fig.1)

For the antimicrobial assay, a micro-liquid dilution method was used, varying the concentration and mixing rate of lysozyme and catechin, respectively. WST viable cell assay solution was used for developmental determination and absorbance was measured.

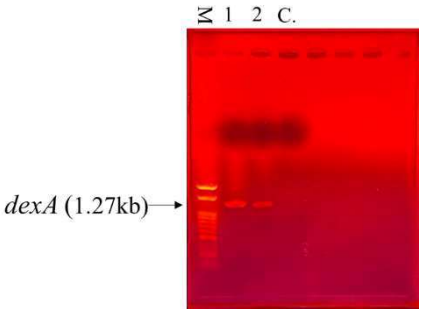

Fig. 1 PCR Results

Results and Discussion

The blue line indicated 150 μg/mL of catechin, the orange line indicated 75 μg/mL, and the gray line indicated 37.5 μg/mL had an OD near 0 regardless of lysozyme concentration. In contrast, the yellow line of 18.75 μg/mL had an OD near 0.6, close to the control value, regardless of lysozyme concentration (Fig. 2). The minimum inhibitory concentration (MIC) of tea catechin in CLC was 18.75 < MIC ≤ 35.5 (μg/mL), while the MIC of tea catechin alone measured in a separate experiment was 150 < MIC ≤ 300 (μg/mL). This indicates that CLC exhibits catechin concentration-dependent antimicrobial activity and the enhancement of the antimicrobial effect shown by Rawdkuen *et al.* 2012 is also observed in *S. mutans.*

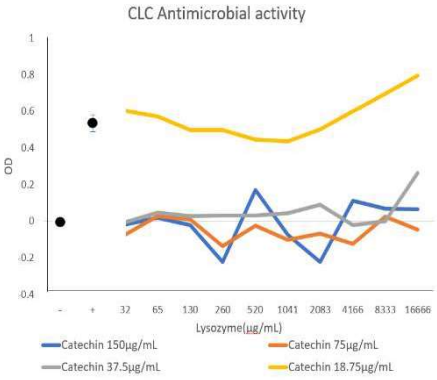

Fig. 2 Antimicrobial assay data

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Kawamura, J., & Takeo, T. (1989). Antibacterial activity of tea catechin to *Streptococcus mutans*. Nippon Shokuhin Kogyo Gakkaishi, 36(6), 463-467.

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Programming - Python

Masanori Adachi

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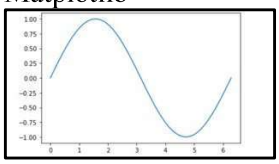
Purpose:

Programming is an activity that many may fear as being difficult, but once one becomes used to the concept of programming, the activity becomes very interesting and enjoyable. Many programming languages seem difficult at first, but after understanding the basic concepts, learning a new language becomes much easier. Understanding code is also crucial in the modern world, because everything we touch and use, from smartphones to automatic doors, function because of code. Out of the numerous programming languages, Python, is considered to be one of the easiest and also the most versatile/useful, which is why understanding the basic concepts of Python is crucial.

Methods:

Concept	Explanation
List [10]: a = [0,1,2,3,4] print(a) [0, 1, 2, 3, 4]	A list in Python is extremely useful, because it can be used to group a group of numbers or letters into one variable. The information can also be extracted individually from the variable by typing the variable and adding a number afterward which specifies where the information is within the list.
NumPy [4]: data = np.array([0,1,2,3,4,5,6,7,8,9]) print(data) print(type(data)) data = np.array(list(range(10))) print(data) print(type(data))	NumPy is a Python library that allows the user to access mathematical functions and use them on arrays. In the example, the various numbers are stored inside the variable "data", and not only is the data extracted, but the type of data is also printed out. In this case, the words <class 'numpy.ndarray'> would come out because it is an ndarray
Matplotlib 	Matplotlib is another Python library that allows the user to plot graphs and add various visual customizations to them. In the example, after importing the Numpy and Matplotlib libraries, an evenly spaced array between 0 and 2π is generated and stored in the theta variable. Then, the sine values of the theta array are plotted.

Discussion:

Python is extremely easy to understand, and can be used for many different purposes once mastered, hence learning Python is very important in any field of study. Because certain concepts such as variables are similar to what one has learned in other subjects, it is easy to make the connection between code and what one has already learned. Furthermore, because this code can be used to display data in different forms, amongst other abilities such as creating animations, Python is extremely useful in the modern world.

Reference:

Chiba University . (n.d.). *Python Programming Course*– Chiba University GSC Project ASCENT Program . Retrieved March 2, 2023, from http://www.astro.phys.s.chiba-u.ac.jp/~ymatumot/lectures/GSC/3a824154b16ed7dab899bf000b80eeee/

The Study of Microbial Fuel Cells Relationship Between Environmental Conditions and Power Generation

Kokono Ishii / Yusei Ohashi

Shibuya Kyoiku Gakuen Makuhari Senior High School, Japan

1. Aim of the study

In recent years, it has been discovered that microorganisms play a physiological role in passing electrons to electrodes. This activity can be used to generate electricity from the mud and other substances in the micro-organisms' habitat. In the process of generating electricity, the microorganisms are also able to break down organic toxic substances that are often produced by the microorganisms in low-oxygen conditions. What we have been looking for is how to make this renewable energy practical. At the moment, the voltage is too low to use it and there are no good materials for the cathode. Today, we focused on the first problem and first studied the relationship between voltage, time and temperature at which microorganisms are generated. Then, based on our experimental results and process findings, we developed a new hypothesis. Microbial fuel cells could be a revolutionary way to generate electricity and help alleviate water problems in developing countries.

2. Research methods

The experimental materials included a container, carbon felt, alligator clips, soil (700 g) and a tester. The soil was mixed with 200 g of water to make a muddy mixture, to which 10 g of vinegar was added and mixed well to activate the bacteria. The experimental procedure consisted of three mud cells with 1 cm of soil underneath, a carbon felt on top of that, another layer of soil on top of that and another layer of carbon felt on top of that.

①The difference in voltage was examined at three different temperatures (room temperature: 20°C, heater: 30°C, refrigerator: 5°C).

②The amount of electricity generated at room temperature with and without plastic wrap.

3. Results and Discussion

①The voltage does not increase much at 5°C and 30°C. Therefore, it is clear that among 5°C, 20°C, and 30°C, the most electricity is generated at 20°C.

②Power is generated better when there is plastic wrap. This is thought to indicate that electricity was generated due to less evaporation of moisture. From the above, it can be seen that more electricity is generated in spring and fall. When the temperature was 5°C, the lower activity of the microorganisms was considered to be the cause of the lower power generation, while at 30°C, the evaporation of water was considered to have reduced the activity of the microorganisms. From the reference experiment, we believe that the system can be used even in summer by controlling the amount of water.

4. References

▪https://www.rikelab.jp/post/3182.html (accessed 14 March 2023)

▪https://letstalkscience.ca/educational-resources/stem-in-context/microbial-fuel-cells (accessed 14 March 2023)

Micro plastic & Our Green Project

NAKAJIMA Hina, IOCHI Riku, TAKAGAKI Minami

Chiba Reimei High School, Japan

Purpose and Background

According to the report, in addition to plastic waste such as plastic bottles, plastic bags and straws, micro plastics floating in the water have been confirmed, and, about 50% of ingredients are polyethylene, about 30% are polypropylene. artificial turf is synthetic resin, and more durable than natural turf. bat, in fact, 23% of the micro plastics came from artificial turf.

For that reason, we started the project that plant natural turf.

Materials and Methods

Since Chiba Prefecture is surrounded by water, we conducted a marine litter survey.

60% of marine litter is plastic. it amount is thought to are than 800 tons. And, micro plastic is 5nm or less in diameter.

We started the project since 2019. April, all school students make turf seedlings, and late June, students from the club and everyone in the community planted seedlings on the ground.

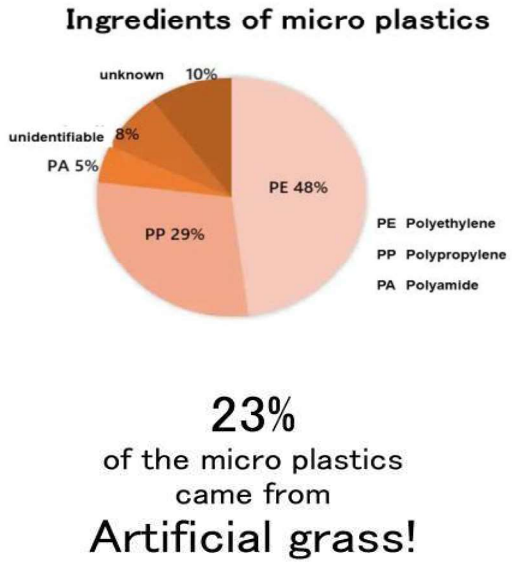
Result and Discussion

We started the project that plant natural grass. Thanks to grass, we active safely. We will continue this activity. Green Project can protect the natural environment**.** Natural turf is more environmentally friendly because artificial turf uses a lot of micro plastic. And, it allows students to spend time safely and comfortably. This time, through this survey, Reimei high school contributed to reducing micro plastic waste, and by continuing this initiative in the future, it will lead to the solution of environmental problems.

Finally, about relationship between what we investigated this time and SDGs, micro plastic may not only destroy marine resources, but affect to our health via marine products.

Also, keeping in mind the 3Rs and need to promote reduce plastic waste activities to reduce waste, and to protect the abundance of the sea, we need to work to reduce marine plastic.

We thought clean up environment by our natural grass.



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   Plastics in a Circular Economy | Ellen MacArthur Foundation
2. From the report of Co. Ltd./General Incorporated Association Pirika 2018

Variation in survival rate by their personality type difference in flies

Chenyu Lee

Chiba Municipal Inage Senior High School, Japan

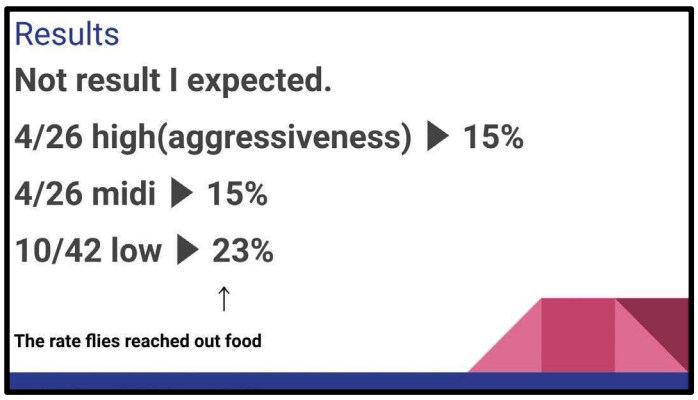
Purpose and Background:

Previously, *Drosophila* flies started to appear in my kitchen. To catch them, I set up a commercial trap. At first, most of the flies were caught in the traps, but after a month or two, a few flies stopped coming. So, I wondered what the difference was between the flies that were caught and those that were not. I thought that the difference might be due to the difference in the personality of the flies.The purpose of this research was to measure survival rate of flies in certain conditions.

Materials and Methods:

Fill the left-most, one-fifth of the clear box with a mixture of grape juice and agar. Place a fly on the right end of the box and leave it there for 20 minutes, and measure how well the flies are fed. These flies are placed in the experimental arena and their activity is studied by the distance they move over a certain period of time. The video recording lasted 66 minutes in total, and the amount of movement during the last 44 minutes of the video recording was used to measure activity. The first 22 minutes were excluded from the analysis because the flies had just awakened from anesthesia and were accustomed to the device.

Results and Discussion



These are the results of how many flies reached the food.

There were three kinds of personality, which are separated by their momentum. The percent of flies with high motility that reached food was 15, medium also 15, and low 23 which is different from expectation. Two hypotheses can be came up with here; First is simply that the experiment failed. Under this consideration, it is possible that the effect of anesthesia was responsible. We anesthetized the flies by spraying them with carbon dioxide when restraining their movements, and we took 30 minutes to measure them, so I think they will be fine.

Second is the fly hunger situation. Of course, the flies used for measurements must be taken into account, as well as their hunger status. The solution to this would be to increase the sample size.

What Can be Seen Through Bird Droppings

Miyu Oishi, Eco Nakano, Chie Hirata

Tokyo Metropolitan High School of Science and Technology, Japan

Purpose and Background

Currently, the world is experiencing a variety of environmental problems, such as abnormal weather conditions and human-induced environmental impacts. One of these environmental problems is the impact of marine microplastics on living organisms. However, since plastics are originally made on land, there is a possibility that some problems are occurring on the ground as well. In fact, it has been reported that microplastics are floating in the air. Therefore, we wondered if microplastics might be affecting organisms on land as well as in the ocean. In our research, we focused on birds, which are familiar to us as land creatures. Birds are widely distributed in their habitats and feed on a variety of foods, including insects, small fish, and nuts. By examining their droppings, I thought it would be possible to understand the impact of microplastics on the environment. I started my research not only on bird droppings, but also on the organisms that are preyed upon by birds.

Materials and Methods

Before the experiment, here is our prediction. Small fish think microplastics are food and eat them. In addition, it has been reported that microplastics accumulate in the bodies of marine organisms, so guppies may not be able to expel microplastics as well(Fig.1). We conducted an experiment based on the prediction that the feces of birds, which prey on small fish, insects, and nuts, contain microplastics. Guppies were fed the prepared microplastics and observed and analyzed using a stereomicroscope and an infrared spectrophotometer(Fig.2). The collected feces were also processed, observed and analyzed using a stereomicroscope and an infrared spectrophotometer.

Fig.1 Guppy used in experiments

Fig.2 Containing pseudo-MP

Results and Discussion

(i) Spectral measurements of the humus showed that it contained the MP that was given to the guppies. This indicated that the guppies had taken MP into their bodies and could expel it.

(ii) Observations revealed mostly insect wings and legs, but we were able to identify fibrous MP-like material. We measured the spectrum of the MP-like material with an infrared spectrophotometer and were able to confirm a spectrum that appeared to be polyethylene terephthalate. In this study, we were able to confirm MP-like material in bird droppings(Fig.3), suggesting that MP has an effect among organisms. We also found fibrous PET in the bird droppings, which we speculated to be fleece from clothing(Fig.4).

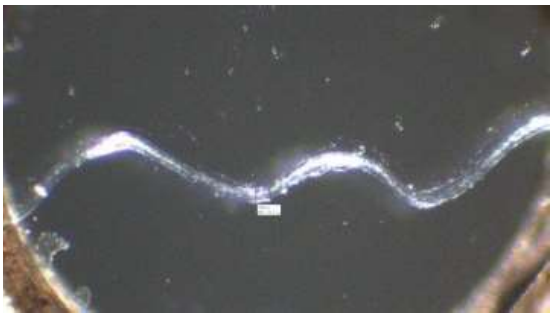


Fig.3 Contents of bird droppings (PET)

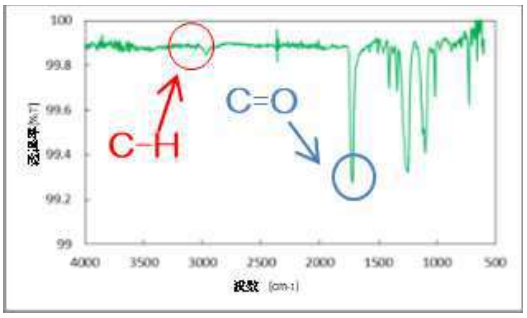


Fig.4 Results measured by infrared spectrophotometer

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Screening for salt-tolerant PET-degrading microorganisms

Rina Kuniya

Tokyo City University Todoroki High School, Japan

Purpose and Background

Marine pollution has become a problem in recent years, affecting the ecosystem. When I learned that a microorganism called *Ideonella sakaiensis*, which could utilize PET as an energy source was isolated from a contaminated recycling plant, I thought that there might be microorganisms that use PET as an energy source in the contaminated ocean, and thus began this research. The purpose of this study is to find salt-tolerant PET-degrading microorganisms.

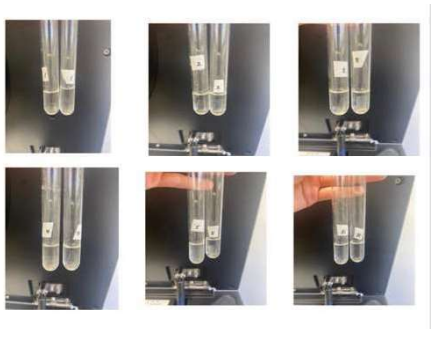
Materials and Methods

First, we prepared seven samples. We collected sea water samples from the sea near the Red Brick Warehouse and the sea in Kumihama, Hyogo Prefecture, and soil samples from the Matsudo campus of Chiba University. I thought I should try soil samples also, not just seawater, so I screened soil as well. We added these samples and a 1 cm^2 PET sheet to the growth medium. This created a situation in which only PET-based organisms could survive in the medium. Since the number of microorganisms that could survive on PET alone would be reduced considerably, we also added casamino acid as the sole energy source so that organisms with a slight preference for PET could survive.

Results and Discussion

Only the marine samples collected in the sea near the red brick warehouse one week after the start of the experiment showed a slight white turbidity in the test tubes (Fig. 1). Although this cannot be precisely said because the PET was not degraded and also because the energy source was casamino acid, it is likely that there are microorganisms that prefer PET and are attached to the sheets. It took two months for PET to clearly degrade in the previous study, so we still need to give it time. We will be looking at the next seven samples for some time.

Fig. 1



Reference

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Proceedings

（Postgraduate Students）

Youth Drain,
A Preliminary Case Study in Migrating Japanese Youth

Milanka Marinkovic

Mahidol University, Thailand

Background and Purpose

During this global Covid-19 pandemic many areas of society throughout the world took many heavy hits across all sectors however during this time the mental health of the youth generation across the entire globe took a toll as the emotional distress in youth and young adults rose to an all-time high. With a larger number of youths entering the workforce in a stage of distress many are choosing to look abroad for different opportunities. Japan is no exception to this youth migration. However, Japan is not only seeing an increase in brain drain as in the emigration of "highly trained or intelligent people" but also in losing "blue collard" workers, those who are considered "low skilled". Globally youth are experiencing later starts in marriage, families, and careers than before due to the lack of resources and options however with Japan's rapidly aging population paired with newer trends of lower birthrates it is vital to begin this conversation before this migration trend can sustain negative economic impact. This preliminary research is meant to open the conversation as to what factors are driving *Youth Migration* within the context of the country of Japan but with the hope that it can be taken further and contextualized globally.

The purpose of this preliminary case study is to begin the discussion of underlying core reasons for youth migration in Japan. Japan has always dealt with migrating educated skill workers but now paired with the blue-collar working class looking for opportunities abroad the influx may not be sustainable. Though a decision to leave one's country is personal there are certain core elements that are universal. The concept of security and sense of self, youth decide to emigrate in order to find a "better life" for themselves. This preliminary case study hopes to utilize the in-depth interview process to be able to dissect an extremely contextual and nuances topic such as emigration in order to provide a baseline on where to focus first so that countries may retain their youth population with ease instead of combating a "brain drain crisis". With Japan's rapidly aging population and declining birthrate it is important for discussion to begin so that measures can be taken to ensure a secure working-class population for all generations current and future.

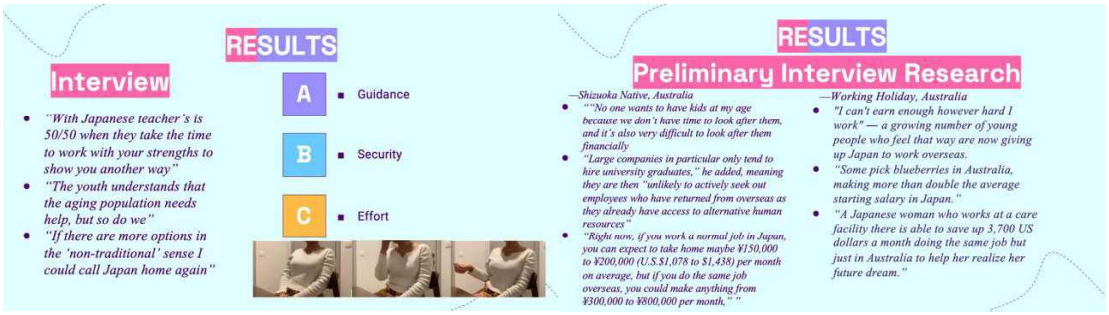
Materials and Methods

The Materials used within this preliminary study are interview transcripts, video interview, written notes, verbal reports, preliminary literature review.

The Methods used within this preliminary study were an In-depth Interview process and observation.

Results and Discussion

Though migration can be looked through a generalized statistical lens the choice to leave one's home country is extremely personal and nuanced that numbers alone cannot represent. With a one-on-one in-depth interview with Japanese Migrant "Kari" age 23, spoke freely about her reasonings and experiences for choosing to leave Japan at only the age of 18. Initially with the start of the interview concepts and theories of self-identity, duty, and expectations presented themselves as a possible factors of driving youth migration but with deeper discussion with "Kari" three core reasoning could be dissected through the reasonings given of youth migration on the fundamental level.



Within the in-depth interview the concepts of guidance, security, and effort thread through all questions and answers presented, whether when focused on the theory of self-identity, on the reality of the educational system, or societal expectations through discussion it was boiled down to the point that options and guidance is key to keep youth feeling secure and with a secured youth population the individual effort outputted would see a drastic increase. Paired with the preliminary research of previous interviews with migrating youth from Japan these three concepts jump out as core reasonings when dissecting their nuanced and personal experiences.

Though students across all high schools in Japan are always at various levels and abilities the opportunities for their strengths to rise the reasonings to work hard and attain various skills should be presented to them in a way that allows the input of effort to match the output of achievement. If students are educated on the various possibilities to apply their highest skills within Japan many would not need to seek opportunities outside Japan. The concept of having options and choosing where to put the individual youths' best effort seems to be the consensus of the interview. If a youth is shown the various pathways to achieve their full potential, they would not feel the need to look at different countries to see if they can attain more with their current level of effort given. Japan possesses an educational system strong and secure enough to engage in this conversation. There are many opportunities for Japanese youth to be able to achieve their individual dreams without having to look abroad. The first step into securing Japanese youth staying in Japan to do their best is to show them all the ways Japan allows them to use their unique skills and abilities to contribute to a better society for all including themselves.

Conclusion

In conclusion, the aim of this preliminary case study was to determine underlying factors effecting youth migration within the context of the country of Japan. From the initial interview process and literature review the underlying nuanced concepts of Guidance, Security, and Effort provide a solid foundation to examine these in depth on a larger scale within not only the youth in Japan but in any country with increased youth migration.

With even just this conversation started educational leaders and those working with this generations youth can keep these concepts in mind and make their personal contributions in retaining the youth they teach within their countries. To show the pathway to security and a life of achievement fundamentally without unnecessary wastes in effort is what all youth should have guidance in attaining.

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BALI IN THE ROLE OF SUSTAINABLE DEVELOPMENT GOALS

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Introduction and Background:

The Sustainable Development Goals (SDGs) are a set of 17 goals to reduce poverty, protect the environment and improve living standards globally by 2030. SDGs were launched and adopted by world leaders and 193 countries on 25 September 2015. The SDGs serves as a compass for the world so that we can meet our responsibilities to succeeding generations to provide a tangible guide to our daily lives – a set of reference points to advise us what to do as peoples, as consumers, producers, civil society, business, and policy makers.

Tri Hita Karana, which means 'Three Ways to Happiness' is an ancient philosophy for life on the island of Bali, Indonesia. This traditional belief emphasizes the harmonies of people with people, people with nature, and people with spiritual in the pursuit of Happiness. Following the inauguration of the 17 Sustainable development goals in 2015, Governments, Businesses and civil society together with the United Nations have actively started to mobilize efforts to achieve the Sustainable Development Agenda by 2030. The SDG Pyramid was launched at the United Nations platform on the International Day of Happiness 20 March 2017 as a way to align the UN goals with happiness. In an effort to promote the SDG, United in Diversity Foundation together with SDSN initiated the SDG Pyramid framework inspired by the Balinese philosophy, Tri Hita Karana (THK FORUM, 2022)

Materials: Sample of SDGs aspect Implemented in Bali

SDG1: No Poverty and SDG2: Zero Hunger

Due to Covid-19 Bali become the worst province that took bad impact in Indonesia. It because all of the economic sector in Bali run by tourism field (Bloomberg, 2020). But they are still many who can survive realize to help others. We can survive because we believe in Tri Hita Karana. Those will reduce poverty and hunger in society's role.

SDG6: Clean Water and Sanitation and SDG 7: Affordable and Clean Energy

Government has important role to built infrastructure in Clean water and Sanitation. Titab dam is the biggest dam in Bali. Beside as an irrigation channel, this Dam is also functioned as water supplier and as a hydroelectric power plant through six villages in 2 districts in Buleleng. Infrastructure prepared and built by government also for Clean Energy. Giant Solar Power Plant which located in Nusa Penida Island is the commitment of Clean Energy by Indonesia Government and this Power Plant first operated during G20 Summit in 2022.

SDG9: Industry Innovation and Infrastructure

In Bali there is an invention in infrastructure about road construction which allows long stretches of flyovers to be constructed above existing roads called Sosrobahu. The inventor is Tjokorda Raka Sukawati. It works by rotating the giant concrete by 90 degrees after finishing the construction, so road can still be used during the construction (Hananto, 2010). Sosrobahu has been exported to the Philippines, Malaysia, Thailand and many other country.

SDG10: Reduced Inequalities and SDG5: Gender Equality

Bengkala is an extraordinary village in Bali known for having one of the highest deaf-since-birth ratios in the world. In Bengkala ordinary and extraordinary child going together in the same elementary school. Bengkala village is the symbol for equalities in SDGs. This is because of our concept tri hita karana cannot be separated from Balinese cultural values (Suyadnya, 2009). This concept also represent of Gender Equality in SDGs.

SDG11: Sustainable Cities And Communities

In Bali there is no tall building due to government rule. It capped every building should not more than 15 m height. Just like our believe between human and spirit. It can keep Bali from overpopulated. The Balinese also has community right called Desa Adat it make Bali has the good social and communities.

SDG12: Responsible Consumption And Production

Jatiluwih village has been defined by UNESCO as a world cultural heritage because it has a unique farm with traditional irrigation system called Subak. Subak is irrigation system developed in the 9th century is a traditional ecologically sustainable irrigation system which is using the concept of Tri Hita Karana. (World Heritage Convention, 2012). This subak can sustain consumption and production keep available because the Indonesian

staple food is rice which is from Ricefield.

SDG13: Climate Action
Bali has mangroves forest with more than 1,373.5 hectares. Mangroves are powerful carbon sinks. They suck up carbon dioxide from the air to store in their roots and branches, as well as the sediment that collects around them. They do this so well that they can store up to 10 times more carbon than forests (The Guardian, 2021). This planting mangrove is one of climate action in Bali.

SDG14: Life Below Water and SDG15: Life on Land
Pemuteran Village, located in Buleleng Bali is known as a marine conservation area for the world's largest "Biorock" artificial coral reef project. Several foundations and local communities are actively involved in managing coral reef conservation efforts. Penglipuran Village located in Bangli Bali was recognized among the top three cleanest villages in the world according to the readers' choice in travel magazine CN Traveler. Penglipuran was included in the Sustainable Destinations Top 100 version of the Green Destinations Foundation.

SDG16: Peace, Justice and Strong Institutions and SDG17: Partnerships for the Goals
Bali blessed because often being a place for the summit, such as G20 summit and also Tri Hita Karana Forum Summit which is works to foster collaboration across the global investment community which has catalyzed in SDG-linked projects. As the last pyramid framework in SDGs: Peace, Justice and Strong Institution and Partnership for the Goals is important to collaborate between nations to work together to make SDGs 2030 possible.

Results and Discussion

It is serendipitous that the 17 goals aligns with Balinese philosophy of life Tri Hita Karana around the harmony of people, ecology and spiritual. The first ten goals relate to the harmony of people that addresses people or social issues such as poverty, education, and health. The next five goals relate to harmony with nature addressing sustainability in urbanization, climate change, and biodiversity. The final two goals relate to harmony with the spiritual calling for inner strength and faith to bridge peace and collaboration within and across sectors and cultures. The sustainable development goals presented in the pyramid framework is a beautiful reflection of aspirations to happiness through the harmony of social, ecological and spiritual values that will universally guide mankind.

Figure 1 SDG Pyramid based on Balinese philosophy of life Tri Hita Karana

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Fostering Teaching Competencies in STEM Education for Preservice Natural Sciences Teachers

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Abstract: This study focuses on determining the STEM educational competency of final year students majoring in natural science education at pedagogical universities in Vietnam, thereby developing this important competency building program for students before graduating to become natural science secondary school teachers. Questionnaire surveys and in-depth interviews were conduct among 4th-year natural science education students at different pedagogical schools in Vietnam. The results reveal that final year students have an average STEM education competencies. Despite the implementation of STEM education-related modules in the natural science education curriculum, some key component competencies were found to be below average. The study also demonstrates that the lack of STEM education competencies to meet the implementation of the secondary education program is not only related to the content of the training program but also closely linked to the method and form as well as organize this competency training for students. Finally, the study proposes the program content and methods of fostering technology-based STEM educational competencies for last-year students in natural science education so that they gain the competence to carry out STEM educational activities for secondary pupils before graduation to become a professional secondary school teacher.

Keywords: teaching competencies, STEM education, secondary education, natural science, teacher training

1. The study was conducted for 4-th year students, majoring in Natural Sciences pedagogy, University of Education, Vietnam National University, Hanoi..
2. Research content
   - STEM education competence of students
   - Evaluation of the STEM education competency training program for students
   - Methods of fostering STEM educational competence for students
3. Reseach results
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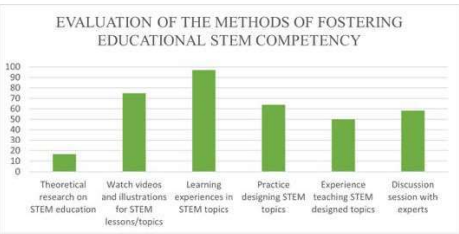

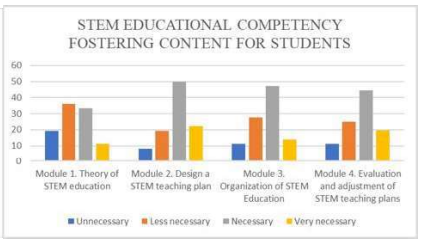

From this study, there are some recommendations proposed to Vietnam's pedagogical universities, namely: it is necessary to develop some specialized modules to train STEM educational competencies for students. In which, it is necessary to focus on training contents on designing STEM learning topics for natural science education students. Connect STEM knowledge and skills to real-life problems. In addition, the process of training STEM educational competencies for students needs to actively apply a learning strategy with practical experiences to ensure that upon graduation, students have the competency to conduct teaching STEM topics for natural science education students.

Enhancing Civic Scientific Literacy through the Implementation of an Inquiry-Based Instructional Unit in Physical Science

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Purpose and Background

Society cannot function efficiently without the latest developments in science and technology. To name a few, the advancement of GPS using satellite technology enables us to travel in unfamiliar places with ease, the field of fiber optics greatly improved the speed of internet connections, and the production of a number of materials has never been more convenient because of the rise of 3-dimensional printers. As much as these developments benefit humans and their quest to build a more modern and mature world, it has also paved the way for destruction and war. The combustion of fossil fuels to power man-made technologies led to the exponential increase in the production of greenhouse gases resulting in increasing the earth's ambient temperatures which resulted in short- and long-term detrimental environmental effects. These scientific issues have adverse effects on society as a whole. These issues are called Socio-scientific Issues (SSIs).

In line with the adverse effects caused by the progression of science and technology, there have been calls for a more formal articulation of caution in interpreting scientific data and evidence (Harremoës et al., 2002). The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) proposed the Precautionary Principle which highlights the shift from post-damage control to a pre-damage control of the problems and issues' risks, and underlying sources in indeterminacies, ignorance, and uncertainties. The vital tenet is that "when human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm". In the same vein, the United Nations (2015) established the Sustainable Development Goals (SDGs) that would serve as a blueprint for achieving a progressive world where all people are accounted for. In response, the Education sector expands and evolves its aims and objectives in line with the SDGs. Particularly, the 4th SDG highlights the safeguarding of "inclusive and equitable education" and promoting lifelong learning opportunities for all. As the disciplinal subjects offered at all levels of the curriculum can equally contribute to the attainment of this SDG, science education has specific roles to play.

It has been established that scientific literacy is the ultimate goal of science education (Zeidler et al., 2019). However, with the prevalence of SSIs, certain components of scientific literacy should be emphasized more. According to Naganuma (2018), a scientifically literate person should not only know the features of scientific evidence but also use it carefully (USE), be able to explain scientific inquiry (ESI) and make informed decisions regarding socio-scientific issues (MD). Collectively, these components of scientific literacy are termed Civic Scientific Literacy (CSL). Civic Scientific Literacy is the ability of a person to recognize, confer, reason, and make decisions regarding scientific issues that greatly affect society (Naganuma, 2018). To make this explicit in curriculum and instruction, this study proposes that teachers may utilize inquiry-based instructional models that enable students to experience, understand, and apply the scientific way of solving scientific problems that may affect society. For instance, the 5E Instructional Model of Inquiry by Bybee (2016) allows students to "redefine, reorganize, elaborate, and change their initial concepts through self-reflection and interaction with their peers and their environment." With this, this study aims to investigate the effects of implementing a 5E-Instructional Unit in Physical Science on the Civic Scientific Literacy levels of students.

Materials and Methods

This study utilized a concurrent embedded mixed method research where data acquired from quantitative methods are complemented by qualitative methods to make an interpretation. A one-group pre-test-post-test design was employed where a pre-test measure was followed by the implementation of a 5-E Instructional Intervention in Physical Science and a post-test for a single group. The instrument used to measure CSL levels, which was administered as both pre- and post-tests was the Assessment of Civic Scientific Literacy (ACSEL) (Naganuma, 2018). ACSEL consisted of 10 constructed response questions that were scored using a rubric. On the other hand, qualitative measures such as interview protocols, class overt observations, analysis of student activities, and worksheets were employed after administrating the pre-and post-tests, and during the implementation of the intervention. Quantitative and qualitative data were analyzed using measures of central tendency and paired samples t-tests, and phenomenological approach and content analysis,

respectively. The study was conducted in a public school in Mandaue City, Cebu, Philippines, and the respondents were Grade 12 Senior High School students (n=39) who took up the Humanities and Social Sciences track. Furthermore, this study underwent processes of ethical review by the Ethical Research Committee (ERC) and sought consent from the Department of Education, the principal, teachers, parents, and students.

Results and Discussion

Results from the analysis of the data determine whether an effect of teaching with an inquiry-based approach on selected topics in Physical Science can be inferred in this study. For both pre-and post-tests, the mean scores were calculated and compared using paired samples t-test. Another paired samples t-test is used to identify whether a significant difference exists for each competency that falls under CSL. Statistical results are summarized in Table 1.

Table 1. Comparison of Pre- and Posttest Scores for the Different CSL Competencies

	Pre-test[a]	Post-test[a]		*p-value (one-tail α = 0.05)*
	M(SD)	*M(SD)*	*t (90)*	
ACSEL Score	**8.77(11.86)**	**13.05(19.68)**	**4.76**	**0.001**
Using Scientific Evidence	2.97(3.70)	4.44(5.36)	3.03	0.003
Explaining Scientific Inquiry	1.56(2.41)	3.28(3.47)	4.42	0.002
Making Decisions	4.23(2.08)	5.33(1.12)	3.85	0.002

[a]n = 39

Furthermore, the mean posttest gain (M=4.28, SD =0.64, N=39) was significantly greater than zero, t (38) = 4.76, two-tail p = 0.001, providing evidence that the intervention is effective in increasing Civic Scientific Literacy levels with a 95% confidence interval between 2.99, 8.56. Consequently, all the sub-competencies follow the same trend. The three sub-competencies, Using Scientific Evidence, Explaining Scientific Inquiry, and Making Decisions, all showed improvement with 1.47, 1.72, and 1.1 positive gains, respectively. While the ESI competency showed the highest gain, it is observed that students still scored lowest for this competency. Consistent with interviews and observations, students feel intimidated whenever they have to deal with scientific terms such as *hypothesis, abscissa, coordinates,* and *slope.* They expressed that they would not attempt to interact with discussion and test questions when there are terms that are *for scientists only.* However, it has been observed that students tend to be more participative when they are genuinely curious. They are only genuinely curious if they feel that they are part of the discussion of SSIs. To take part in the discussion, they have to be knowledgeable about the terms and processes involved. In terms of laboratory activities, it has been observed that students become more confident in making their own experimental procedures after exposure to several recipe-like ones.

As the construct of Civic Scientific Literacy being a multifaceted topic is composed of several sub-competencies, a closer look into the individual sub-competencies might result in a better picture of what are the points of improvement in terms of teaching and learning activities. As mentioned, it might also be better to focus on the sub-competencies of CSL at a time rather than taking all of them at once and considering their effect combined. Such specific focus might establish more concrete evidence of the favorable effect of the Inquiry-Based Approach on CSL.

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The Analysis of Science Teachers' Needs for ESD-based Teaching Materials on Climate Change Topics

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Purpose and Background

Implementing Education for Sustainable Development (ESD) is critical to overcoming current environmental challenges. The United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2013 mentioned that it is an effort for every nation around the world to build awareness, create knowledge and foster understanding of sustainability and climate change. As we live in a time when we are reminded daily of all the environmental problems created by humans. In line with it, the implementation of ESD is important to overcome the various environmental problems that are occurring today (Ekamilasari et al., 2021).

Unfortunately, Indonesia has not yet incorporated ESD into the school curriculum, let alone the implementation. There have not yet existed any government-issued learning materials suitable for conducting learning activities based on ESD (Setyowati et al., 2022). Education and, more specifically, school as an institution play a leading role in the implementation of sustainable development (Imara & Altinay, 2021).

The main goal of this research in this paper is to contribute to the issue of teaching materials that teachers need for opening the new possible way of infusing ESD-based teaching materials into climate change topics. The purpose of this study is to analyze science teachers' needs for ESD-based teaching materials on climate change topics.

Materials and Methods

The aim of this study is to analyze in-depth and explore the need of science teachers teaching materials ESD-based related to the climate change topic. The method of this study is survey research that analyzes data with descriptive. Questionnaires were distributed to the research in January 2023. The subjects were 20 teachers who taught science courses in junior high school. The respondents from this survey were junior high school teachers from Tasikmalaya, Bandung, Tanggerang, and Cimahi Region.[1]

The data in this study were collected using a questionnaire about teacher profiles, teacher knowledge about ESD, and the information regarding teaching materials they use regularly in their classroom. The initial knowledge of the teacher about ESD is illustrated in questions 1-3 which will be discussed in depth in this study. It aims to explore teachers' knowledge in determining ESD aspect and its definition. Because an important work of teachers in ESD is to regulate specific subject so they can integrate the competencies for sustainability with the goals that SGDs has been approved (Novidsa et al., 2020). The other analysis of teaching materials needed by a teacher is demonstrated in questions 4-10 which will be one of the focuses of this study.

Results and Discussion

The paper concludes the analysis of this research for teaching materials in climate change that science teacher need. The statistical information about the respondents' group demographic 70% of the participants was female, while 30% were male. The result of the questionnaire shows that only 35% of the teachers are ever heard about ESD and the number is decreasing when the question about the meaning of ESD to 20% (Figure 1). In the upcoming question to strengthen what are the aspects of ESD only 15% of them are answering Yes. The researcher also provides the essay question teacher knowledge in ESD but none of them answer correctly.

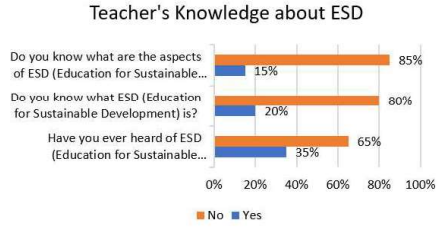

Figure 1 Result of the questions about teacher knowledge of ESD

Based on the result all teachers are using teaching materials in delivering climate change topics. There 30% of teachers thought that the teaching materials that they use are hard to understand. Only 35% of the teacher never created or developed their teaching materials about climate change. 85% thought that there will be better if there is other teaching materials that can support the science learning process on climate change topic. We also explore teacher experience using ESD-based teaching materials and show data only 15% has been used ESD-based teaching materials in their classroom setting. Also, half of the respondents agree that the value of ESD is relevant if it is taught at the junior high school level. They also agreed that teaching materials ESD-based on climate change topics will be more interesting to have in their school to be applied in their classroom.

However, the knowledge of education for sustainable development (ESD) is not prevalent completely in Indonesian educational institutions. The aspect of ESD is not covered in current climate change classes taught in junior school science classes in Indonesia. However, signs of teaching materials with ESD-based are found a prospective to provide a better teaching-learning process in several Indonesian cities, including Tasikmalaya, Bandung, Cimahi, and Tanggerang. The survey was conducted among junior high school science teachers. Based on the teacher's needs analysis, the majority of participants agreed that ESD-based teaching materials will reinforce teachers to conduct climate change topics in science classrooms.

Conclusion

In our view, there is still a lack of teachers' knowledge about ESD in Indonesia. So, it will be hard for them to support the goals of ESD in Indonesia. The impact of the concept of sustainable development is significant in both understanding and interpretation, therefore very important for considered knowledge about it (Skill et al., 2022). The government needs to reinforce teachers and assist the teaching-learning process in the class can be infused by the ESD value. Appropriate education on climate change issues should be incorporated into school curricula so that all students will be fully aware of climate change issues in the future (Trott & Weinberg, 2020; Williams & McEwen, 2021). Teaching materials based on ESD can be a new possible solution to provide a new perspective to provide a better teaching-learning process on climate change topics.

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RESEARCH UTILIZATION OF SCIENCE TEACHERS

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Background

Research utilization is the process by which research findings are incorporated into practice to improve outcomes. It is a critical component of evidence-based practice, as it ensures that research is translated into meaningful changes in practice. In the field of science education, research utilization has the potential to improve the quality of science teaching and learning and promote the achievement of science education goals. Despite the potential benefits of research utilization in science education, research has shown that science teachers often struggle to effectively incorporate research findings into their teaching practices. In recent years, efforts have been made to promote the utilization of research in science education. However, more research is needed to understand the extent to which science teachers are utilizing research findings in their teaching practices. In Thailand, there are still quite a few studies on research utilization also in science teachers. Then, the pilot study was conducted to measure using of research in their practices, found that science teachers tended to use research but, the measure was unclear. In summary, this research aims to draw conclusions about the measurement of research utilization of science teachers who play an important role in learning and teaching science conducted by the Confirmatory Factor Analysis.

Purpose

To develop and validate the measurement model of research utilization of science teachers.

Hypothesis

The measurement model of research utilization of science teachers fitted with the empirical data.

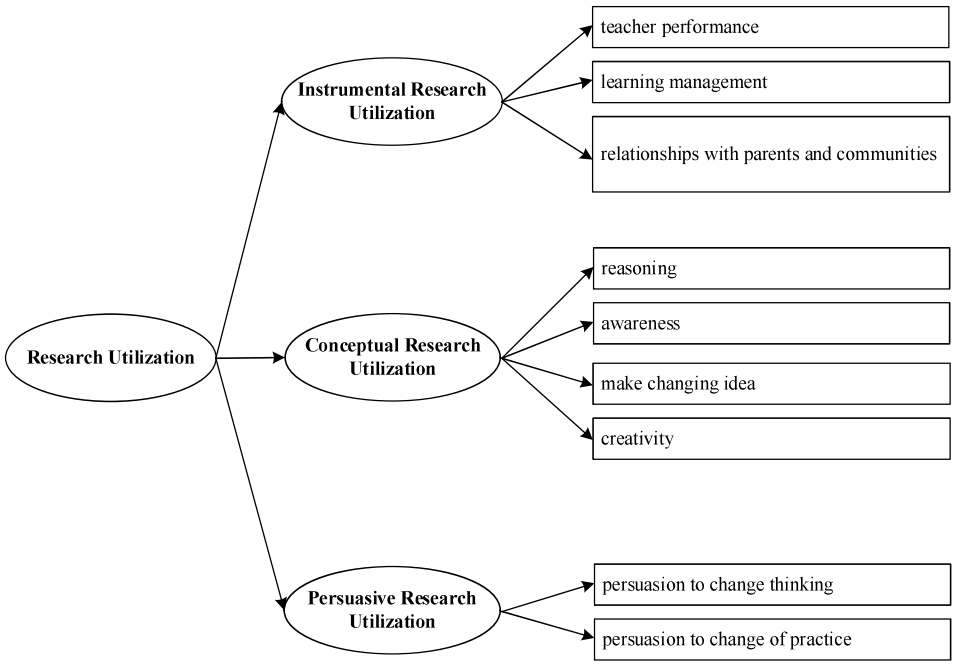

Figure 2: Hypothesis model of Research Utilization of science teachers (Estrabrooks et al., 2011; Squires et al., 2011; Thailand teacher council, 2020)

Methods

The population of this study were 8,082 science teachers in northern Thailand. The sample for this study was based on rule of thumb; ratio of sample unit to free parameters in hypothesis model was 20 sample unit: 1 free parameter. The sampling method used was done in two stages. The first stage was a stratified

random sampling by classifying teachers into 2 levels were elementary education and secondary education. The second stage was a simple random sampling to determine sampling unit at n=688 of science teachers

The measurement tool was a research utilization of science teacher questionnaire consist of 34 items in 5 rating scales. The content validity was validated based on IOC=0.6-1.0, discrimination power based on r_{xy}= .686-.848, reliability=0.975.

Results

The model showed an acceptable fitness for research utilization comprise of 3 components. Statistics value showed that a good fit (X^2=24.407; df=15; p-value=0.0585; CFI=0.998; TLI=0.996; RMSEA=0.030; SRMR=0.011) are well represented. For the first order, all observed variables had factor loading in terms of standardized score different from zero at the significant level .01, with values ranging from 0.700-0.924. The second order, all latent variables had high factor loading in terms of standardized score different from zero at the significant level .01, the highest was CRU (β=0.941), IRU (β=0.916) then PRU (β=0.887) showed in figure 2.

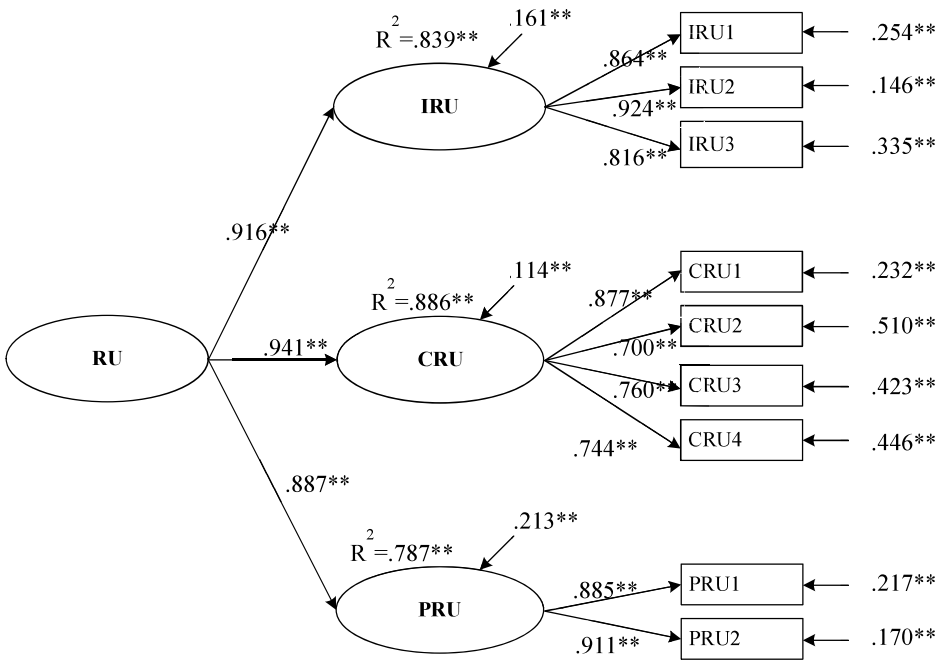

Figure 2: Model result of Research utilization of science teachers.
** p-value<.01

Discussion

The research utilization of science teacher questionnaire was proven to have a valid measurement model and reliable constructs. It was deemed suitable for use to measure the research utilization of science teachers. The measurement model of research utilization of science teachers consists of 3 components and 9 indicators can be applied to the improvement of research utilization according to their priorities.

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OPEN EDUCATION RESOURCES IN PRE-SERVICE TEACHER TRAINING PROGRAMS TOWARD SUSTAINABLE DEVELOPMENT GOAL FOUR

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Purpose and Background:

Open Education Resources (OER) are freely accessible, openly licensed educational materials that can be used for teaching, learning, research, and other purposes. These materials include various formats such as text, images, audio, video, and interactive media. OER has gained much popularity in recent years because of its potential to democratize education by making learning accessible to anyone, anywhere, anytime. Pre-service teacher training programs are designed to prepare future educators for their teaching roles. These programs focus on developing the knowledge, skills, and competencies required to become effective teachers. The incorporation of OER into pre-service teacher training programs can provide several benefits. For example, OER can enhance the quality and relevance of teaching and learning materials, reduce costs for students and teachers, promote collaboration and sharing of resources, and support the development of a culture of openness and innovation in education. Sustainable Development Goal Four (SDG 4) aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. OER can contribute significantly to achieving this goal by providing access to high-quality educational resources and promoting collaboration and sharing among educators and learners worldwide. Furthermore, the use of OER can support the development of a sustainable education system that is based on principles of accessibility, equity, and openness. The purpose of this study is to propose the integration of OER in pre-service teacher training programs can play a vital role in achieving SDG 4 by providing access to high-quality educational resources, reducing costs, promoting collaboration and sharing, and supporting the development of a sustainable education system.

Materials and Methods:

To conduct a study on the integration of OER in pre-service teacher training programs towards achieving SDG 4, the following materials and methods were used: Literature Review: A comprehensive review of existing literature on the integration of OER in pre-service teacher training programs and their impact on achieving SDG 4 will be conducted. This will involve searching relevant databases, journals, and other sources of information to gather relevant data and information. Survey: A survey will be conducted to collect data from pre-service teacher training programs that have already integrated OER into their curricula. The survey will seek to establish the impact of OER on the quality of teaching and learning, cost reduction, collaboration, and sharing, and the development of a sustainable education system. Case Studies: Case studies will be conducted to identify and analyze best practices and success stories of pre-service teacher training programs that have integrated OER into their curricula. The case studies will examine the benefits, challenges, and strategies used to overcome them, as well as the impact of OER on the achievement of SDG 4. Overall, the above materials and methods will provide a comprehensive approach to conducting research on the integration of OER in pre-service teacher training programs toward achieving SDG 4.

Results and recommendation

The results of the study on the integration of OER in pre-service teacher training programs towards achieving SDG 4 are as follows: Improved Quality of Education: The integration of OER in pre-service teacher training programs has led to the improvement in the quality of education by providing access to high-quality educational resources. OER has enabled pre-service teachers to access diverse and up-to-date learning materials that can be easily customized to meet the needs of their learners. Cost Reduction: The use of OER in pre-service teacher training programs has led to significant cost reductions for both students and teachers. With OER, pre-service teachers no longer need to spend money on purchasing textbooks, and they can easily access OER materials online. Collaboration and Sharing: OER has facilitated collaboration and sharing of resources among pre-service teachers and teacher trainers. OER has provided a platform for pre-service teachers to share resources, ideas, and best practices with their peers and teacher trainers, leading to increased collaboration and knowledge sharing. Sustainable Education System: The integration of OER in pre-service teacher training programs has contributed to the development of a sustainable education system that is based on the principles

of accessibility, equity, and openness. By providing free and open access to educational resources, OER has helped to promote a culture of openness and innovation in education. The study suggests that pre-service teacher training programs should consider integrating OER into their curricula. This can be achieved by training teacher trainers and pre-service teachers on the use and creation of OER, creating platforms for sharing and collaborating on OER materials, and promoting the use of OER in teaching and learning. Furthermore, education policymakers should support the integration of OER in pre-service teacher training programs by providing incentives and funding for OER initiatives. Overall, the integration of OER in pre-service teacher training programs can contribute significantly to achieving SDG 4 and promoting inclusive and equitable quality education and lifelong learning opportunities for all.

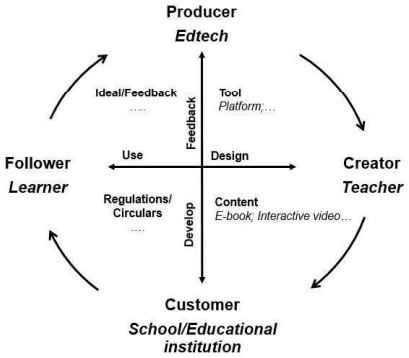

Figure 2:The 5 Rs of Teacher Education

Based on the results of the study, the following recommendations are suggested to further promote the integration of OER in pre-service teacher training programs towards achieving SDG 4: Building a shared database in schools and educational institutions: Schools and educational institutions can establish a shared database to store and share OER materials among teachers and learners. This can facilitate easy access to OER materials and promote collaboration and sharing among teachers and learners. Integrate OER-building skills training into pre-and in-service teacher training: Teacher training programs should integrate OER-building skills training to equip pre-service and in-service teachers with the skills and knowledge required to create and use OER materials. Engaging EdTechs to participate in the development of OER: Education technology companies can be engaged in the development of OER materials by providing technical expertise and resources to create high-quality and innovative OER materials. Integrate OER in teaching with learners and create an Edu-Eco-System: Teachers should integrate OER in teaching and learning by encouraging learners to use, recreate, create, and develop OER materials. This can foster an Edu-Eco-System that promotes the sharing and collaboration of educational resources among learners and teachers. TWINCLE participating countries jointly research and develop OER for a standard field/industry/level of study: TWINCLE participating countries can collaborate to research and develop OER materials for a standard field/industry/level of study. This can lead to the creation of high-quality and standardized OER materials that can be easily shared and used across borders. Building a shared OER platform for TWINCLE: TWINCLE can establish a shared OER platform where participating countries can share and collaborate on OER materials. This can promote the sharing and collaboration of OER materials among TWINCLE participating countries and contribute to achieving SDG 4

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MULTISPECTRAL IMAGING FOR PIGMENT IDENTIFICATION ON KING RAMA V AND HIS QUEEN PAINTING

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Purpose and Background

King Rama V and his queen painting is archived in the memorial hall at Chulalongkorn university. It was painted by an anonymous with an unidentified background. The university wants to conserve the painting with the exact pigment without destroying it. Therefore, this research aims to identify the pigments used in this painting with a non-destructive method.

Multispectral imaging (MSI) has been suggested as a method for pigment identification as an advantage of not destroying the sample. In summary, multispectral imaging is the combination of IR-VIS-UV filters and full-spectrum camera that can be acquired images from 3 spectral bands, which are UV-A (360-400 nm), Visible (400-700 nm) and IR (780-1100 nm). And the different ranges of light sources will project on the sample. Cosentino [1] established a flowchart method for pigment identification based on the acquisition of 8 MSI methods.The methods contain VIS (visible), IR (infrared), UVF (UV fluorescence), UVF254 (UV fluorescence at 254 nm), UVR (UV reflected), IRFC (infrared false color), IRF (IR fluorescence), and IRR (infrared reflectography).

Materials and Methods

The MSI images were acquired with a Canon EOS 5D (30.4 MP, COMS sensor) digital camera modified for full spectrum (between 360 and 1100 nm). The filters used in this research are B + W 403 filters for the UV-A filter (Schneider Optics), X-NiteCC1 filter for the visible filter (Maxmax) and Heliopan RG1000 for the infrared filter. Halogen lamps are used for visible and infrared range photography, visible LED lamps is used for visible range photography, and UV LED lamp are used for UV-A range photography.

The areas of analysis are selected by the color appearing under visible light which is red, yellow, green, blue, black, brown, and white, as shown in figure 1. The results taken from the painting were compared with a collection of swatches of 56 historical pigments, as shown in figure 2. The results from MSI images were narrowed down and confirmed with the results of elements found in the painting from X-rays fluorescence spectroscopy (XRF).

Figure 1 The areas of analysis on the king Rama V and his queen painting.

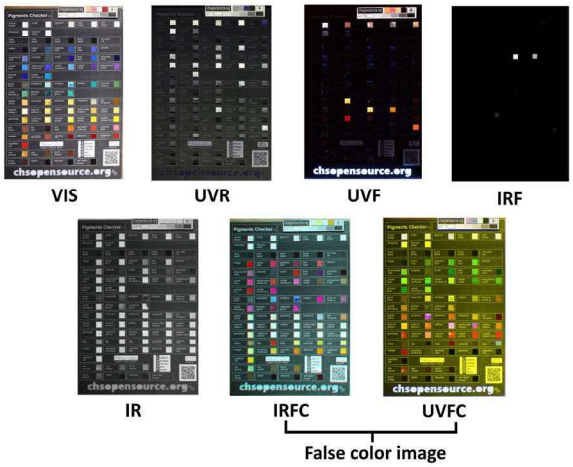

Figure 2 A collection of swatches of 56 historical pigments under 6 MSI methods.

Results and Discussion

An example of an analysis of the yellow pigment area is shown in figure 3. From the results on MSI, the area appears yellow in VIS, brown in UVF, light yellow in IRFC, and pink in UVFC, decreasing the scope of all historical pigments to 6 possible yellow pigments. Combined with XRF, the results show the traces on 23.21% of Ca, 6.93% of Pb, 2.17% of Fr, and 1.75% of Cr correspond to the characteristic of yellow ochre and chromium yellow.

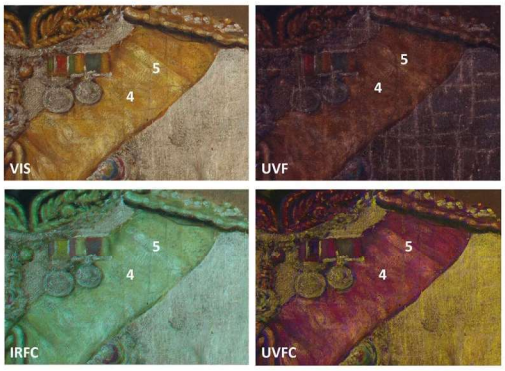

Figure 3 yellow pigment area on the painting appeared under VIS, UVF, IRFC, and UVFC.

In addition to the other areas, the expected pigments used in the painting from the results of MSI images and XRF spectroscopy are shown in table 1. However, it is essential to note that MSI methods are effective for single-layer pigment identification, while in the painting, pigments are often mixed and overlapped in layers. It is recommended that MSI should be used as a complementary to chemical analytical methods.

Table 1 Expected pigments used in the painting from the results of MSI images and XRF spectroscopy

Color	Pigments
White	Titanium white, Zinc white
Black	Carbon black, Ivory black
Brown	Raw umber, Burnt umber
Red	Alizarin red, Red ochre
Yellow	Chrome yellow, Yellow ochre
Green	Chrome oxide green
Blue	Maya blue

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Geospatial analysis of sea level rise in small island, Karimunjawa, Indonesia

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Purpose and Background

Many parties have expressed concern about climate change (Miller, 2020). This is due to the direct and indirect impacts caused by climate change in several regions of the world. One of the obvious impacts is sea level rise. Based on satellite altimetry data (2023), global average sea level is increasing at a rate of 3.56 mm per year. Lately, this phenomenon has had an impact on several regions in Indonesia, especially in coastal areas. For example, a mosque in Jakarta, settlements in West Java, and a school in Central Java were all submerged (**Fig. 1**).

Fig. 1 a Mosque; **b** settlements; and **c** school in northern Java. Sources: Trans7 Official (2019); Watchdoc (2021).

In addition, there are around 17,000 islands in Indonesia, and many of them are classified as small islands because their area is less than 2,000 square kilometers (Mutaqin et al., 2022). Some of these islands are important for regional development, for example Cemara Besar is important for tourism in Karimunjawa because it has become a local and international tourist destination. Furthermore, this island has been a national park since 1999. Therefore, multi-hazard mapping to identify the derivative effects of climate change and sea level rise is important as part of coastal management.

Materials and Methods

The Coastal Hazard Wheel (CHW) method is used in this study, along with several parameters such as geological layout, wave exposure, tidal range, flora/fauna, sediment balance, and storm climate (Appelquist et al., 2016). UAV data and georeferenced points are used as input data to produce the DEM and orthoimages. The orthoimages are then processed using ArcGIS software to generate shoreline data. Following that, the shoreline data is divided into segments with a maximum length of 200 m. Afterwards, each segment is filled with parameter data. The geological layout data comes from the DEM, while the rest comes from CHW classification system. All the parameter information of each segment is then compared to the CHW to identify multi-hazard classes and suitable measures.

Results and Discussion

The results consist of five maps, including ecosystem disruption (**Fig. 2a**), gradual inundation **(Fig. 2b**), salt water intrusion (**Fig. 2c**), erosion (**Fig. 2d**), and flooding (**Fig. 2e**). The maps show that all of the coasts in Cemara Besar have a very high level of ecosystem disruption, salt water intrusion, and flooding hazards, while there are two levels for gradual inundation and erosion that are high and very high. The high level is located in the northern and eastern parts of Cemara Besar because these areas are relatively protected. Later, the high and very high levels of each hazard indicate that these areas need several kinds of suitable measures. According to Appelquist et al., (2016), there are several measures suitable for this level of ecosystem disruption, i.e. coastal zoning, ecosystem based management, groundwater management, and wetland restoration. For gradual inundation, those are beach nourishment, coastal setbacks, coastal zoning, dikes, flooding proofing, managed realignment, and wetland restoration. Later, for salt water intrusion, those are coastal zoning, dikes, groundwater management, and wetland restoration. Also, for erosion, there are beach nourishment, breakwaters, coastal setbacks, coastal zoning, groynes, managed realignment, revetments, sea walls, and wetland restoration. Finally, for flooding, there are coastal setbacks, coastal zoning, dikes, flood mapping, flood proofing, flood shelters, flood warning systems, managed realignment, tsunami warning system, and wetland restoration.

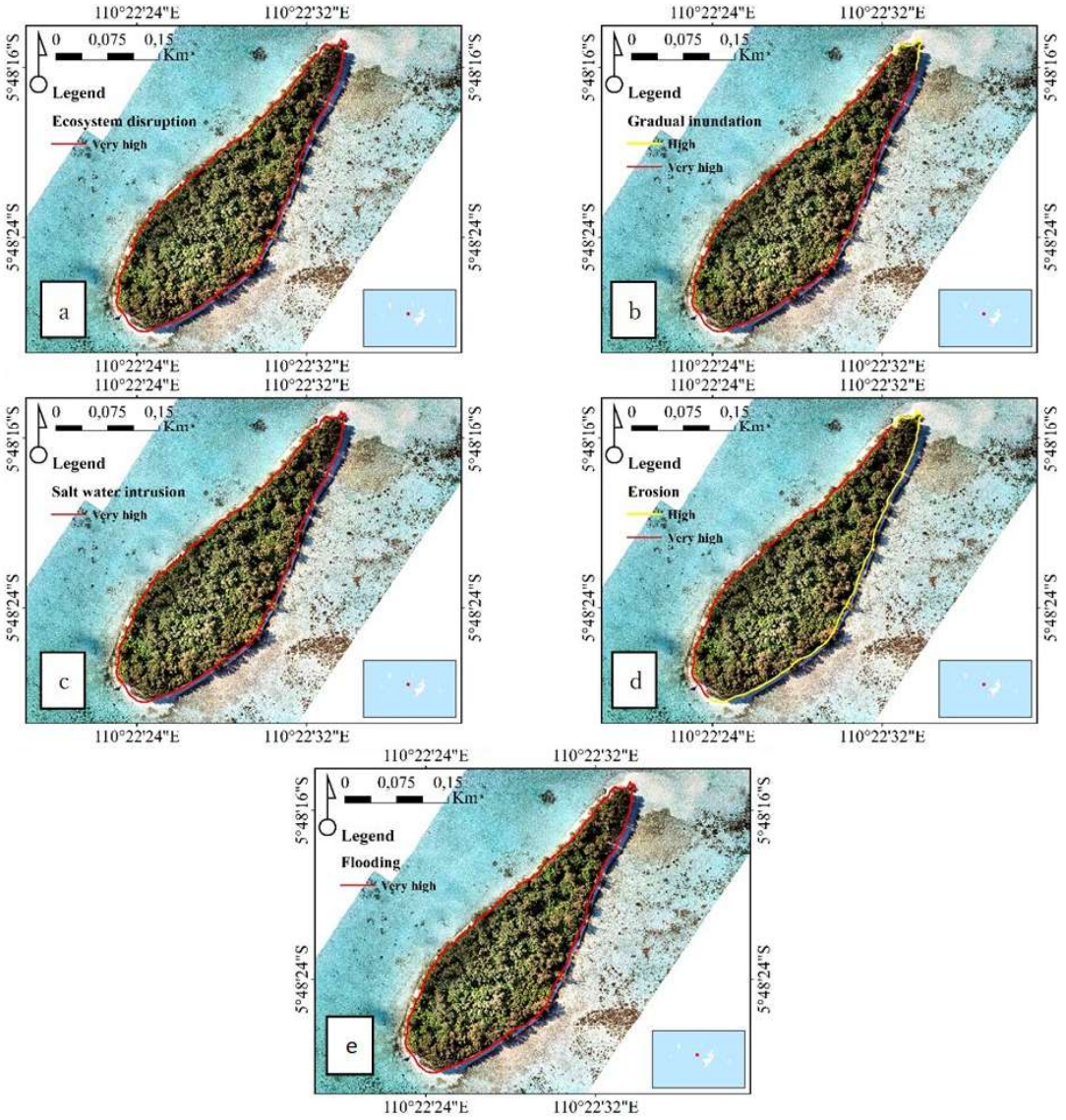

Fig. 2 Multi-hazard maps of Cemara Besar island: **a** ecosystem disruption; **b** gradual inundation; **c** salt water intrusion; **d** erosion; and **e** flooding.

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AN ENHANCED SECURITY LIGHTWEIGHT ENCRYPTION FOR LOW-COST IOT DEVICE BASED FARMING

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BACKGROUND

Internet of Things (IoT) has transformed the smart agriculture industry into a data-rich industry and helps increase profitability while maintaining efficiency and cost-effectiveness. Despite being beneficial for industrial productivity. The varied use of IoT devices has exposed the potential for cyberattacks and vulnerabilities in the agricultural sector (Bogdanov et al., 2007). Due to inadequate investment, digital security concerns and level of application skills, pose risks to data generated from IoT devices (Sontowski et al., 2020). IoT devices continuously read and store data, therefore, secure communication is necessary to achieve confidentiality, integrity, and authenticity. Data Leaks and manipulation might have detrimental effects, due to the fact that the data provided plays a crucial role in real-time decision-making, for example altering data about soil moisture levels would lead to excessive watering that harms plants and results in financial losses (Gupta et al., 2020). It is crucial for the smart agriculture industry to comprehend the effects of cyberattacks and be aware of the problems with data security that arise due to the massive use of IoT devices. Implementing encryption for low-cost security as security primitives can protect data communications on IoT devices and reduce commodity production costs. Due to constrained computational capability of IoT devices, such as Raspberry Pi 1 with a clock speed of 700 MHz, lightweight, low-cost, and robust encryption is required. A lightweight symmetric encryption algorithm modifications aim to reduce the trade-off between randomness, performance, and security. This research aims to develop a security model that has efficient performance while maintaining and enhancing the security of lightweight encryption algorithms, thereby suitable for use in resource-constrained devices and environments for low-cost IoT devices-based farming. The research hypothesis is randomness of key encryption can be increased by adding entropy for *Pseudo Random Number Generator* (PRNG). Then followed by reducing number of keys and rounds, to achieve low performance load to be applied to low-cost and constrained IoT devices and environments.

RESEARCH METHOD

Numerous lightweight encryption block cipher modifications and related work have been done, the following is reference of the encryption algorithm carried out in this study. Block cipher is type of symmetric block cipher that uses two different techniques, Substitution Permutation Network (SPN) and Feistel network (FN).

Table 1. Lightweight encryption related work and proposed of design and analysis

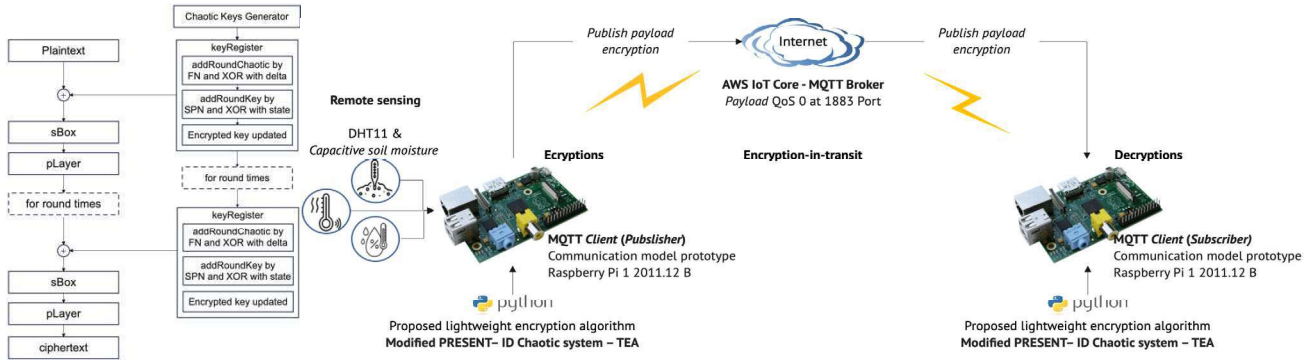
Algorithm	Author	Key(bits)	Block(bits)	Rounds	Techniques	PRNG
PRESENT	(Bogdanov et al., 2007)	80, 128	64	31	SPN	Cryptographic PRNG
SAT Jo	(Shantha & Arockiam, 2018)	80	64	> 31	SPN	User input
SIT	(Usman et al., 2017)	64	64	5	Feistel, SPN	User input
Modified PRESENT - TEA	(Chatterjee & Chakraborty, 2020)	80	64	25	TEA, SPN	Cryptographic PRNG, delta value
Modified PRESENT - 5D Chaotic system	(Jawad Kubba & Hoomod, 2020)	128	64	31	SPN	Cryptographic PRNG, 5D chaotic system
Modified PRESENT - 1D Chaotic system - TEA	This Research	64	64	5-31	TEA, Feistel, SPN	Cryptographic PRNG, 1D chaotic system, delta value

This research proposed a modified PRESENT algorithm with Delta value of TEA and 1D chaotic system using SPN and FN method to manage random key generator entropy. Furthermore, reducing number of keys and rounds while maintaining the security of the encryption. The equation form of the 1D logistic map $x_{n+1} = ux_n\,(1 - x_n)$ can represent complex random behavior. A high randomness value can be obtained if the control parameter u is in the range of $3.57 < u \leq 4$ (Bhavya Garg et al., 2018). Evaluation of security models and performance each algorithm is evaluated at low-cost IoT device Raspberry Pi 1 2011.12 Model B. For security evaluation will be measured the avalance effect, that considered random if the value is more than 50%. For load performance evaluation will be measured time execution, CPU usage, and memory usage every 5, 10, 15, 25, and 31 rounds.

RESULTS AND DISCUSSION

One of the cryptographic problems is generating a non-linear cryptographic PRNG with small values and simple operations. Keys generated by cryptographic PRNG software are not truly random. Other sources of entropy are required to increase key randomness and encryption security from cryptographic and minimum key length that must be identical to the length of the plaintext (Jean Philippe Aumasson, 2018).

Figure 1. Implements an enhanced lightweight encryption algorithm and a prototype security model



The results of proposed algorithm, using a combination of the PRESENT, TEA, and 1D Chaotic system algorithms, with SPN and FN methods using less number of keys which is 64 bit and less the 31 rounds, succeeded in increasing the randomness of the key and lower the performance load. The algorithm proposed get the highest avalanche effect's value by 52% of the algorithms compared, while the others avalanche effect value is PRESENT 49%, SAT Jo 14%, Modified PRESENT - TEA 50%, Modified PRESENT - 5D Chaotic system 50%. The proposed algorithm also shows the highest performance value for the execution time of the fastest encryption process starting from 0.021 s for 5 rounds to 0.208 s for 31 rounds, and the execution time for the fastest decryption process starting from 0.021 s for 5 rounds to 0.186 s for 31 rounds of compared algorithms. Then the proposed memory usage algorithm shows the same low value as the PRESENT algorithm, which is 5.0 KB. While the results of the performance evaluation on the CPU usage, the proposed algorithm shows a high performance load of 7.49%, when compared to the reference algorithm with the smallest value of 6.42%.

Table 2. Result of comparative performance and security evaluation

Algorithm	*Time execution in seconds (Encryption) at rounds*						*Time execution in seconds (Decryption) at rounds*					
	5	*10*	*15*	*20*	*25*	*31*	*5*	*10*	*15*	*20*	*25*	*31*
PRESENT	*0,028*	*0,069*	*0,107*	*0,144*	*0,200*	*0,255*	*0,019*	*0,054*	*0,084*	*0,123*	*0,172*	*0,213*
SAT Jo	*0,023*	*0,063*	*0,100*	*0,146*	*0,183*	*0,244*	*0,025*	*0,048*	*0,079*	*0,127*	*0,154*	*0,209*
Modified PRESENT - TEA	*0,026*	*0,070*	*0,119*	*0,144*	*0,221*	*0,239*	*0,023*	*0,057*	*0,098*	*0,120*	*0,188*	*0,192*
Modified PRESENT - 5D Chaotic system	*0,027*	*0,074*	*0,121*	*0,150*	*0,197*	*0,244*	*0,024*	*0,066*	*0,095*	*0,130*	*0,176*	*0,208*
Modified PRESENT -1D Chaotic system - TEA	*0,021*	*0,071*	*0,111*	*0,138*	*0,172*	*0,208*	*0,021*	*0,062*	*0,096*	*0,114*	*0,152*	*0,186*
Algorithm	*CPU usage in % at rounds*						*Memory usage (KB) at rounds*					
	5	*10*	*15*	*20*	*25*	*31*	*5*	*10*	*15*	*20*	*25*	*31*
PRESENT	*1,82*	*3,66*	*5,67*	*7,04*	*8,76*	*11,59*	*4,954*	*4,985*	*4,985*	*5,017*	*5,048*	*5,048*
SAT Jo	*2,10*	*4,13*	*6,12*	*7,63*	*8,50*	*10,71*	*4,970*	*5,001*	*5,001*	*5,032*	*5,063*	*5,063*
Modified PRESENT - TEA	*2,18*	*4,03*	*5,91*	*8,53*	*9,08*	*11,37*	*5,057*	*5,057*	*5,057*	*5,057*	*5,057*	*5,057*
Modified PRESENT - 5D Chaotic system	*2,69*	*5,44*	*6,96*	*8,58*	*11,10*	*13,94*	*5,240*	*5,503*	*5,703*	*5,966*	*6,105*	*6,318*
Modified PRESENT -1D Chaotic system - TEA	*2,20*	*4,90*	*6,94*	*8,26*	*9,44*	*13,18*	*5,041*	*5,041*	*5,041*	*5,041*	*5,041*	*5,041*

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Life extension with modified microstructure of nickel aluminium bronze seawater pump impeller by heat treatment

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Purpose and Background

Nickel aluminium bronze (NAB) is a copper-based alloy containing 9-12 wt.% Al including Fe and Ni up to 6 wt.% . As its good combination of mechanical properties and corrosion resistance, it is widely used for seawater applications such as impeller pumps. During service, the synergism of cavitation damage (mechanical) and corrosion occurs simultaneously which is called cavitation corrosion damage. The consequence of the damage is the replacement with the new one which related to cost and utilization of the resource. As NAB is a multi-phase alloy containing α, β', and $\kappa_{I\text{-}IV}$ precipitates, the corrosion onset usually occurs from phase and microstructure. Cavitation corrosion in NAB initiated at α-κ_{III} interface as described in the previous documents [Al-Hashem, Caceres, Riad, & Shalaby, 1995; Basumatary & Wood, 2017; Riad, 2002; Wharton, Barik, & Kear, 2005]. To mitigate cavitation corrosion, the corrosion onset phase κ_{III} should be dissolved by heat treatment process at temperature of 890°C. The modified microstructure will withstand NAB for long lasting which corresponds to SDGs goal 9 Industry, Innovation and Infrastructure.

Materials and Methods

As-cast nickel aluminium bronze (AC-NAB) was cut into size of 20 mm × 20 mm × 5 mm. To modified the microstructure, the AC-NAB was heat treated at 890°C for 30 minutes then rapidly cooled in water (named as HT890/30). The AC-NAB was used as a control sample to compare with the heat-treated sample (HT890/30). Both of control and heat-treated samples were metallographic prepared by grinding with sand paper down to grit No.1000 and polishing with 3 and 1 μm diamond stick. The samples were corrosion tested by immersion in 3.5% NaCl solution for 6 months and cavitation corrosion tested by ultrasonic vibratory device for 5 hours. Weight loss after cavitation corrosion was determined by 5-digits precision balance (OHAUS; Pioneer, PX125D). After testing, the samples were then cross-sectioned, cold-mounted and metallographic prepared to examine their microstructures using optical microscope (OM; ZEISS, LSM900) and scaning electron microscope (SEM; FEI, NOVA NANOSEM 450). Phase ratio in the microstructure was determined by Image J software. Micro-hardness measurement was achieved with load of 10mN using nanoindenter (FISHERSCOPE®; HM2000).

Results and Discussion

Figure 1(a) shows microstructure of as-cast nickel aluminium bronze (AC-NAB) composed of α, β', κ_I, κ_{II}, κ_{III} and κ_{IV} phase. After heat treatment (Figure 1(b)), there were α_{remain}, β^*, κ_I and κ_{II} while κ_{III} phase was disappeared. The β^* phase is a high temperature phase, the α_{remain} is α phase which was still remain after heat treatment. Hardness ($HV10_{mN}$) of α_{remain} and β^* phase was 265 and 489 respectively. The ratio of soft α_{remain} phase to hard β^* phase is 37 to 63 or about 1:2.

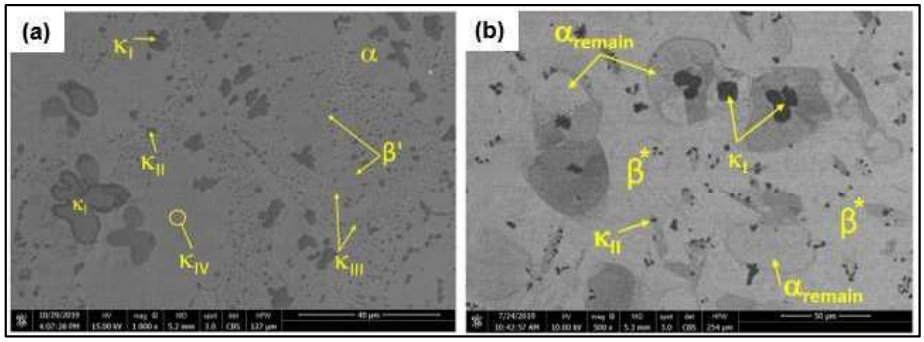

Figure 1 microstruture of (a) AC-NAB, (b) HT890/30

After corrosion test by immersion in 3.5%NaCl for 6 months, the preferential corrosion attacked in AC-NAB was observed at α/κ_{III} interface with a maximum corrosion depth of 14.6 μm as shown in Figure 2(a). In HT890/30 sample, the preferential corrosion attack occurred in β^* phase with a maximum depth of 7.1 μm as illustrated in Figure 2(b). In comparison, the corrosion attack in the heat-treated sample was more superficial than that in as-cast sample about 2 times. For cavitation corrosion test of as-cast sample (Figure 2(c)), a severely damaged was observed in α phase indicated by 8 μm crack length along α/κ_{III} interface. Weight loss of AC-NAB after testing was 4.324 mg. In contrast to as-cast sample, the damaged area in heat-treated sample was observed only at a soft α_{remain} phase which a maximum crack length of only 2 μm. The crack length found in HT890/30 was about 4 times shorter than that in as-cast sample (Figure 2(d)). Additionally, weight loss of HT890/30 was only 1.264 mg. It is indicated that the modified structure successfully mitigate the cavitation corrosion damage implying long lasting of materials.

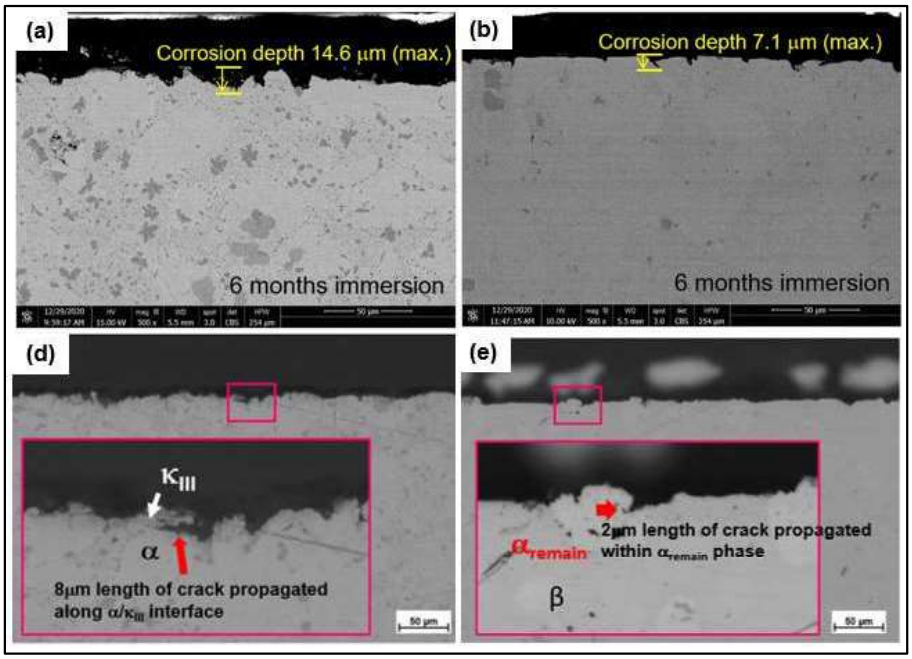

Figure 2 cross-section microstruture of
(a) AC-NAB after corrosion for 6 months, (b) HT890/30 after corrosion for 6 months,
(c) AC-NAB after cavitation corrosion for 5 hours, (d) HT890/30 after cavitation corrosion for 5 hours

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Effect of Oxide Presence in Activated Carbon on Arsenic Removal

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1. Background and Purpose

Many studies have been done in order to improve the water quality of contaminated water using activated carbon (AC). The activated carbon (AC) has been used as an adsorbent to remove not only As [1] but cationic methylene blue (MB) dye from aqueous solution, synthetic heavy metal ions (Pb^{2+} Cu^{2+} and Zn^{2+}) and Pb(II) from an aqueous solution [2]. It is because it is low in cost and environmentally friendly. The effectiveness of arsenic removal from As (V) solution was enhanced by using granular activated carbon (GAC) and iron together (GAC-Fe) [3]. GAC-Fe resulted in a higher Langmuir maximum adsorption capacity at pH 6 (1430 μg/g) compared to GAC (1013 μg /g). In addition, the zero point of charge (ZPC) of GAC-Fe (pH 8) was found much higher than that of GAC (pH 3.2). ZPC of pH 8 suggests that the GAC-Fe surface is positively charged at pH 6, rendering favorable adsorption of the negatively charged As.

The objective of this study is to develop and compare the candidate materials based on granular activated carbon (GAC), which was studied for As removal by many researchers mentioned above. Further, the effect of various oxides on the As removal efficiency was investigated when they were used together with granular activated carbon (GAC) in the form of a mixture. For the practicality of this study, a local well water near Phnom Penh contaminated by As was obtained and used for analysis.

2. Experimental

2.1. Preparation of Adsorbents

Granular activated carbon (AC) powder in the range of 0.8~2mm in size was used in this study, after passing sieves of 2- and 0.8-mm opening. The AC powder was first cleaned by stirring the mixture of 20g AC and 200 ml of 0.1M H_2SO_4 for 1h at 100 rpm using a magnetic stirrer. Subsequently, it was washed several times with deionized water until the wash water becomes colorless. Then, the samples were dried at 100°C for 24h in a dry oven to remove moisture and any volatiles. Further, KOH was mixed, in an AC-to-KOH ratio of 1:6 in weight, to remove the surface debris and extremely fine AC powders. The mixture was heated at 5 °C /min to 750 °C and cooled slowly at 10 °C/min and it was named as ACK (1:6).

Iron oxide was synthesized by a coprecipitation method as described in [4]. First, 1.74 g of $FeCl_3 \cdot 6H_2O$ and 0.62 g of $FeCl_2 \cdot H_2O$ was dissolved in 50 mL of deionized water. Then, 5mL of 0.414M NaOH solution was mixed dropwise into the solution with vigorous stirring. In this process, black precipitates were formed after stirring for 20 min. The solution with the precipitates was centrifuged at 4000 rpm for 10 min and the particles were washed with deionized water 5 times and dried in an oven for 15h at 100 °C.

Similarly, the synthesis of manganese oxide follows the same procedure as iron oxide was done.

The adsorbents with each oxide were produced simply by mixing oxide powder with granular AC powder in DI water with stirring and subsequent drying. 2g of dry AC was mixed with 0.2g of iron oxide or manganese oxide (10:1 in weight ratio) in 50 mL of deionized water, using an ultrasonic vibrator for 1h. Additionally, the mixture was stirred for 5h at 100 rpm for uniform mixing and then dried for 24 h at 100 °C in an oven.

3. Results and Discussion

3.1 Characteristics and Morphology of Base Materials for Adsorbents

Microstructures of base materials, such as as-received AC, as-screened AC, and oxides, were examined, using optical, FE-SEM, and XRD. Fig. 1 shows FE-SEM micrographs of as-received AC and oxides, α-Fe_2O_3 and Mn_3O_4, which were identified as such by XRD as described below. Iron oxide produced by a co-precipitation method is in the range of 100-500 nm in diameter and its shape is smoothly faceted. However, the particle size and shape of manganese oxide are significantly different from that of iron oxide. The particle size is in the nano range, i.e., 50-100 nm, and the shape is irregular but flake-like, indicating a higher anisotropy in surface energy than that of iron oxide. Both oxides are found agglomerated, as expected, due to the high

Effect of pH

The removal efficiency of various absorbents made of these base materials is also compared with that of ACK (Fig. 6). It is certain that the pH value has a strong impact on the As adsorption capacity. In general, neutral water of pH 7 and/or base water exhibits superior performance among those of a limited number of samples. The highest removal of As (~95%) took place at pH 7.0 with ACK-Mn_3O_4 and it was chosen as an optimum pH condition for further experiments.

Effect of Adsorption Time

When the KOH treatment was taken into consideration, there was no consistency in the adsorption behavior. However, AC-KOH of 1:6 weight ratio exhibited a steady increase in the adsorption, reaching up to 70~75%. Most AC samples showed little improvement in performance after the lapse of 30 min. Thus,

Effect of Adsorbent Amount

Thus, it was concluded for this study to use 50mg of adsorbent for 50 ml of well water as a proper adsorption amount. The presence of the oxides in AC, especially Mn_3O_4, improved the performance significantly. It was found optimal in this study that the ratio between the amount (dosage) of adsorbent and well water (1g/L).

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Tables and Figures

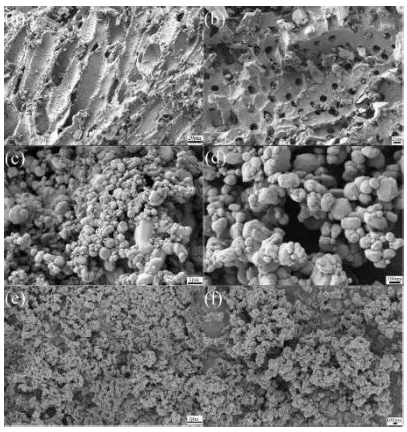

Figure 1: FE-SEM Micrographs of (a,b) As-received AC, (c,d) Fe_2O_3 and (e,f) Mn_3O_4

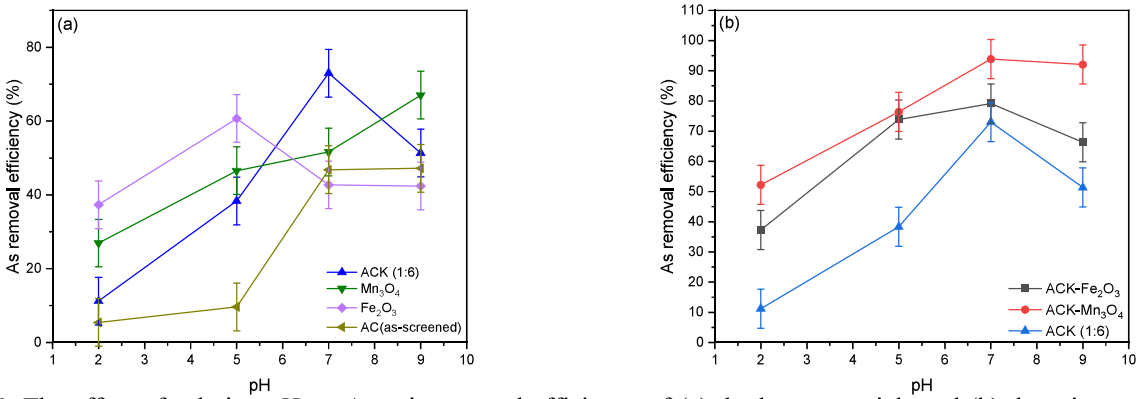

Figure 6: The effect of solution pH on Arsenic removal efficiency of (a) the base materials and (b) the mixtures. All adsorbents (50mg) were left for 30min in the well water (50ml) of 2.35 ppm in Arsenic concentration.

VARIABILITY OF CHLOROPHYLL-A IN KARIMATA STRAIT, INDONESIA AND LABUAN, MALAYSIA

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Purpose and Background

The most significant component of the food chain in a body of water is sea surface chlorophyll-a (SSC), which is a useful metric for assessing the prospective productivity of fishing regions. The waters in Labuan Island (Malaysia) and the Karimata Strait (Indonesia) are interesting waters to study because these waters have the potential for fishery resources (fishing ground) and affected by the seasonal monsoon. More effective and realistic monitoring of SSC concentrations near the surface is achieved by remote sensing of sea color which provides spatial and temporal synoptic data that cannot be obtained by in situ sampling The data is extracted from monthly Moderate-Resolution Imaging Spectroradiometer (MODIS) Level 3. In recent years, MODIS imagery has been widely used due to its high spectral resolution, high temporal and spatial data, free data, and fast acquisition (Wirasatriya et al., 2021; Napitupulu et al., 2022). SSC tends to absorb blue and red and reflects green and is detected by MODIS satellite sensors. This study aims to examine and describe the seasonal variability of SSC spatially and temporally in Labuan and Karimata Strait waters.

Materials and Methods

The study area covered the region of the Malaysian and Indonesian seas with a position between 100°E −121°E and 60°S−12°N in Fig.1. A series of monthly mean SSC data derived ten observation points from the Aqua MODIS Level 3 were collected from the period of fifteen years (2007-2021). Analysis of chlorophyll-a and SST concentrations was carried out in the four seasons, namely West Season (December-February), Transitional Season I (March-Mei), East Season (June-August), and Transitional Season II (September-October). Marine fish landings 15-year monthly data in Labuan Island from the Department of Fisheries Malaysia were collected to understand the environmental and marine productivity within this region.

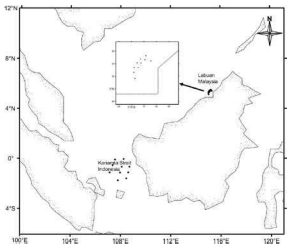

Figure 1. Location ten observation points of the Karimata Strait, Indonesia, and Labuan Coastal Waters, Malaysia

Results and Discussion

The average distribution of SSC climatology each month is shown in Fig.2. The highest average SSC content is identified in January and September where 1.00-1.80 mg/m^3 and 0.80-1.20 mg/m^3 values for Labuan Island and the Karimata Strait respectively. The highest SSC value during the West Season is 1.18 mg/m^3. Seasonal phytoplankton bloom in Labuan waters is strongly influenced by season-induced upwelling and the effects of surface water transport to the South China Sea (Shang et al., 2021). SSC value during the Transitional Season 1 is 0.89 mg/m^3 with the lowest SSC content occurring in April. SSC value in the East Season increased from 0.89 mg/m^3 to 0.95 mg/m^3. SSC value in Transitional Season II is also increased from 0.95 mg/m^3 to 1.5 mg/m^3. The Labuan coast maintains high concentrations throughout the year. However, phytoplankton blooms is emerged from the southern Labuan region in October and extended to its offshore waters (Chuan et al., 2021).

SSC value ranged in Karimata Strait during the West Season is from 0.56 mg/m^3 to 0.58 mg/m^3. SSC value during the Transitional Season 1 with the lowest SSC content occurring in April at 0.38 mg/m^3. SSC value during the East Season increased from 0.49 mg/m^3 to 0.75 mg/m^3. The SSC value in Karimata Strait is increasing from 0.58 mg/m^3 to 0.72 mg/m^3 during Transitional 2. Tropical sea waters generally have low SSC content due to limited nutrients and strong water column stratification. Stratification of the water column is caused by heating

the water surface, which is similar all year round (Susanto et al., 2013). Human activities on the islands of Bangka Belitung and Kalimantan have resulted in the inputs of nutrients and SSC into the Karimata Strait. There is a gradation of high SSC concentration values in coastal areas, especially near the estuaries, and decreases towards the open sea.

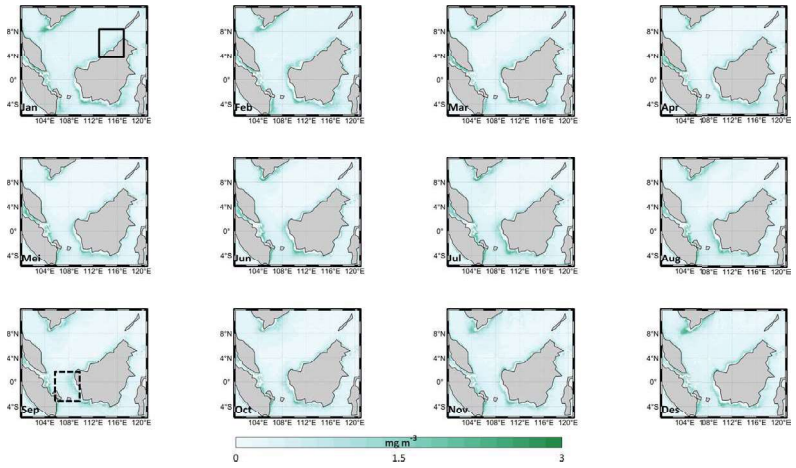

Figure 2. Average monthly of SSC in Karimata Strait and Labuan

The peak distribution of SSC in Labuan Caost occurred in Jan/Feb and Jun (Fig.3A). Sept to Jan had high precipitation (Fig.3C). As a result of high precipitation despite high SSC, the peak of marine fishing landings was highest in Jun, due to lower precipitation compared to Dec and Jan (Fig.4E). The pattern of SSC-Precipitation (Fig.3A-E) corresponds to a positive correlation, the value 0.4. This indicates that there is an adequate relationship between marine fishing landings and precipitation. The largest monthly average marine fish landing is Jun when precipitation is low. The peak distribution of SSC in Karimata Strait is occurred in Sep and Dec (Fig.3B). High precipitation shows an increasing SSC during West Season (Fig.3D). The pattern SSC with precipitation is positively correlated, with a correlation value of 0.82, this shows that there is a strong relationship between these two parameters. Thus, the distribution of SSC values is dominantly influenced by precipitation.

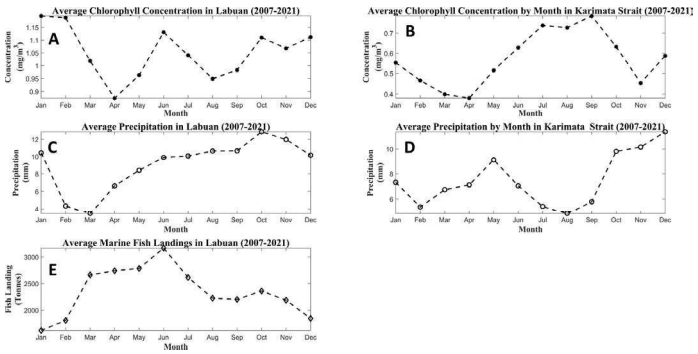

Figure 3. SSC, Precipitation, and Marine Fish Landings in Karimata Strait and Labuan Island

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The effect of stemflow manipulation on two epiphytes at Fushan Experimental Forest

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Purpose and Background

In the humid forest, epiphytes are an important component of biodiversity contributing up to 30% of vascular plants species. Epiphytes are a group of non-parasitic vascular plants which are structurally dependent on other plants. Because they are lack of accessability to the ground, epiphytes rely on the resource from the atomosphere. Stemflow, which means rainfall going through the crown and running down the trunk, is the most critical source (Levia & Frost, 2003).

Climate Change has caused changes in precipitation pattern and longer and more severe drought, which has negative influences on the biodiversity and productivity of plants (Wu et al., 2011). Epiphytes are exposed to the ambient water fluctuation so that could be most sensitive to such changes compared to plants rooted in soil. Therefore, Some researchers consider epiphytes as early indicator group of climate change (Benzing, 1998; Zotz and Bader, 2009), while the others suspect that epiphytes may not be sensitive to climate change. This is because through long-term adaptation, some epiphytes have developed traits allowing them to grow in micro-environment with high fluctuation of water availability (Campany et al., 2021). However, none of the previous field studies focused on the epiphytes due to its unique growing position. Observational studies and common garden studies are commonly used approaches to study the response of epiphytes to changes in water availability (Costa, Zotz & Kleyer, 2018; Nishida & Hanba, 2017). However, both approaches has major limitations making it difficult to explore the causation and simulate the original environment in the forest.

In this study, customary-made stemflow-manipulation devices were set up to explore how drought stress affect two common and long-lived epiphytes, *Asplenium nidus* and *Haplopteris zosterifolia* , in the Fushan Experimental Forest of northern Taiwan for ten months. Our purpose is to explore whether epiphytes are sensitive to the water availability change.

Materials and Methods

The study site was in the Fushan Experimental Forest (24°45'36"N, 121°35'01"E) of northern Taiwan. The forest is characterized as a subtropical rainforest as it rains on average more than 200 days annually, with mean annual precipitation of 3840 mm and monthly mean relative humidity greater than 90% throughout the year (Chang et al., 2017).

Our studied species were *Asplenium nidus* and *Haplopteris zosterifolia* (Fig. 1), which were common in the study site. *A. nidus* has long and wide leaves forming a bowl-shaped crown and humus-rich substrate. *H. zosterifolia* 's leaves is long, thin and pendent, which tend to divert stemflow and throughfall away from the host tree stem (Chen et al., 2019). Based on the their difference in structure, we expected that *H. zosterifolia* would be more vulnerable to the stress.

Stemflow-manipulation device contained collecting and diverting parts (Fig. 2). With the devices, three levels of stemflow reduction were conducted, 0% (Control), - 25% and - 50%. The period of the experiment was during 2020/07~2021/04. There were 6 individuals in each treatment for both epiphytes. We measured the traits indicative of plant growth condition and the stress condition, including number of leaves and total leaf area, and drought stress, specific leaf area, leaf dry matter content, thickness of leaves and cuticle, δ13C and nutrients of leaves, to explore the effects of the treatments.

Results and Discussion

The removal of 25% had limit effect on both epiphytes (Table 1), indicating that 25% stemflow reduction did not reach the water stress threshold for the two epiphytes. It is also possible that the actual reduction in water availability was less than 25% since epiphytes do not use all available stemflow and there could be other sources of water such as fog and throughfall (Chang & Lai & Wu, 2002).

The removal of 50% showed different result between two epiphytes (Table 1). The treatment didn't have significant effect on *A. nidus*. However, the indexs showed that *H. zosterifolia* was under great stress and its

growth was severely impacted. Suprisingly, despite the negative effect on the growth, the treatment didn't have effect on the nutrition and stomatal conductance (Riehl et al., 2014), which means the leaf remain the openness of stomata and also maintain stoichiometry. The results indicated the possible trade-off between the photosynthesis and water regulation. Losing leaves relieved water deficit by decreasing total transpiration and as such maintained the growth of the rest of leaves. Frequent fog and high humidity of the Fushan Experimental Forest may also mitigate water stress of H. zosterifolia . However, if the atmosphere become drier due to the climate change, it could change the composition and relative abundance of different epiphytes species.

Fig. 1 Studied species. *Asplenium nidus* (A) and *Haplopteris flexuosa* (B).

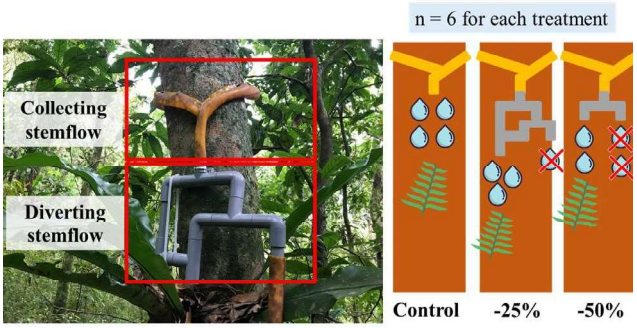

Fig. 2 Stemflow-manipulation device and treatment.

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Supplement

2022 ESD Activity Report

Kanna Kataoka and Manaka Nishikawa

Ichihara Chuo High School, Japan

Purpose and Background

Ichihara Chuo High School (Chiba, Japan) has been working on many volunteer activities and international understanding events as a UNESCO School (authenticated in July 2010). We made plans to tackle problems around the world with teachers and local people, discussing active plans all the time. We'd like to report what we did in 2022, even under the condition of COVID-19.

Volunteer works

"Spo-Gomi" is an innovative activity, which combines picking up garbage with sports. Many students took part in this event. Also, the volunteer activities of collecting disposable body warmers were unique. The disposable body warmers can be changed into a "Go Green Cube", which can clean dirty rivers. This year we also entered the "Chiba SDGs partnership". As a SDGs partner school, we got a chance to learn more about SDGs from a collaboration company. With the help of a collaboration company, we donated many second-hand toys to a children's cafeteria, which offers free food to poor children (Figure 1.). Also, the students in the Global Leader Course (GLC) were active in variety of things. We visited an elementary school online to teach English as a project called "High School students are English teachers"(Figure 2.). We keep doing exchange activities with Kumamoto Kokufu High School. We continued support activities with each other after 2016, when Kumamoto was hit by a huge earthquake. Furthermore, we worked on the "Clothes Power Project" sponsored by UNIQLO (Figure 3.). We collected lots of children clothes, which we put into more than 25 cardboard boxes. Then, we had fund-raising activities for people in Myanmar. We appealed for cooperation, using posters and movies we edited. The money was sent to children's cafeteria through a NGO.

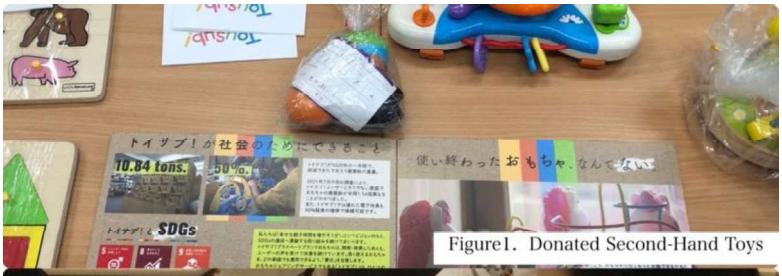


Figure1. Donated Second-Hand Toys


Figure2. English Lessons Online


Figure3. Collected Child Clothes


Figure4. English Camp @ NISEKO

International Understanding

We had many chances to learn practical English and understand different cultures. In the programs we could learn not only English but ideas about SDGs through various group activities. Especially, GLC students were very active. They had study camp programs to find out the problems around the world and to present their ideas to tackle them (Figure 4.). Unfortunately, the 2nd GLC students couldn't go abroad because of COVID-19. But the alternative study tour was carried out in Niseko in Hokkaido. Surrounded with the magnificent nature, they could take lectures on how we can protect the environment. In the GLC, online collaboration classes with schools in Asian countries are held every year. This year we had three collaboration classes with high school students in Thailand. We could have a great time with them using some gestures and facial expressions.

Consideration

In Ichihara Chuo High School, there are a lot of opportunities for each student to think about what they should do to achieve the 17 aims of SDGs in various situations. We'd like to plan for more projects and events in which all the students can take part.

Matsukoku Revolution～Matsukoku can change the world～

MAYA Suzuki, HANNAH Suwa, KAHO Boyama, ELISA Sunaga, and HARUMA Ueda

Chiba Prefectural Matsudo Kokusai High School, Japan

Purpose and Background

Matsudo Kokusai High School (Matsukoku) has two main courses: the General and International, in which we can learn and grow under the diverse environment. Also, as one of the UNESCO-associated schools, we have been working on many activities to support the achievement of SDGs. Looking at each of the activities, it seems that Matsukoku is full of energy and motivation towards thinking globally and acting locally to pursue the better world. However, although students enjoy working on these activities, there are some challenges. For example, the number of students who take part in "Cleaning Volunteer Activity" remain low and SDGs learning ends passively with just giving a presentation. A potential solution to this issue could be that students take a lead in those activities, but they do not even say to their friends, "Let's join it together" or "Let's do this activity together." In order to improve the situation, we have tried to capture the reasons behind and considered an easy but strong and sustainable solution.

Materials and Methods

As a first step, we made a survey of awareness of the activities among Matsukoku students using the questions below; Question 1 (Figure 1): Do you have a self-awareness as a UNESCO-associated school student in your daily school life and activities? Question 2 (Figure 2): Please select all the activities (a: cleaning volunteers, b: SDGs comprehensive research activities, c: an eco-friendly school trip that the school conducted as a UNESCO-associated school) that you have participated in or cooperated with. Question 3 (Figure 3): In relation to Question 2, what did you cooperate with on the eco school trip? Question 4: Did you notice any changes in your feelings and behavior after participating in and cooperating with the activities? Please tell me specifically. By looking at the qualitative and quantitative data from the survey, we came up with ideas to solve the issue.

Results and Discussion

From the results in Figures 1, 2 and 3, our hypothesis that some students might be passive about activities provided was right to some extent; however, there are many students who actively engage in the activities. Based on this situation, we have come up with two solutions: Matsukoku Revolution for Matsukoku to be more UNESCOlized. First, we need to raise the awareness of the core students. It is important that the students with high awareness will take the lead for others. Second, we must motivate the students to get their friends involved in the activities. If students who have raised their awareness involve other students in the activities, they will not feel passive to do something and will proactively participate in our UNESCO activities. We believe that small things can trigger a big achievement if they gather with passion. Therefore, we conclude that these two will lead to revolution in Matsukoku. For future research, we will evaluate and analyze the effect of the solution so that we can keep improving ourselves as a UNESCO Associated School.

Figure 1: Survey on self-awareness

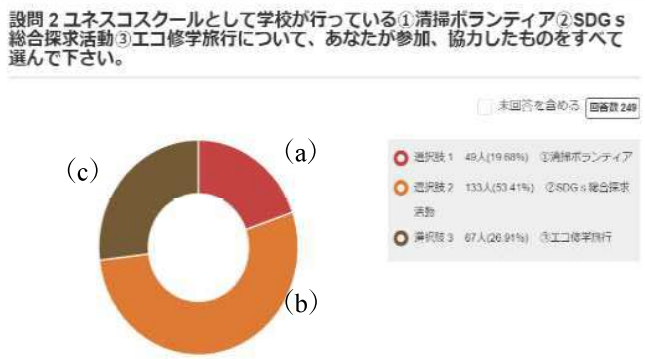


Figure 2: Survey on activities' participation

Figure 3: Cooperation with eco school trip

A New World that I Found

Misaki Ochi

Ferris Girl's Senior High School, Japan

This presentation will be divided into two parts. First, I am going to talk about what I learned through one of the ASCENT program's lectures and second is about what I discovered from the ASCENT program generally.

I had the opportunity to choose a lecture which was entitled "Landscape Design". What struck me most about this course was the word "landscape cemeteries". I interpreted landscape cemeteries simply as graves that are parts of a beautiful landscape. In recent years, the rapid increase in the number of elderly people in Japan and the resulting increase in the number of graves has led to the destruction of nature. This landscape cemetery is a wonderful way to solve this problem and also to restore nature. When I first heard about this, I agreed with it. I think that a landscape cemetery would be a cheerful place for graves, without the tense atmosphere of a regular cemetery that makes it difficult to enter. Examples of this landscape cemetery are tree burial and grass burial, which I heard about for the first time in this lecture. In grass burial, the entire cemetery with its many plants are considered the gravestone, and the stone steps are considered the gravestone characters. When I heard about it, I was surprised by how different it was from the past, but at the same time I was very attracted to the idea of transforming it into a beautiful place. In this lecture, as I said before, I learned that there are many ways to approach one problem of "environmental destruction."

After I finished this lecture, I discussed it with my mother. We thought of an idea of installing a smaller version of a wind turbine propeller in a place of the headstone. By implementing this burial method, we could contribute to solve two major social issues: energy shortage and increased greenhouse gas emissions, which indirectly being involved in nature restoration. However, we also found various problems such as whether it would work as a beautiful landscape or not, require a lot of land, noise, price, and so on. What do you all think of this idea? I found it attractive because it can help people in the future. However, it seems to me that it would no longer be a quiet, peaceful space like a tree burial or a regular grave. I encourage everyone to think about it.

Now, moving on to the second topic. I will talk about what I discovered from the ASCENT program. When I was a third-year junior high school student, I wondered if I just wanted to enter high school and spend 3 years studying or to seize a new opportunity which I could not get at school. From those two options, I decided to take the second one. At that time, I found a poster advertising the ASCENT program. The word "research" really attracted me, and I was excited about the possibility of gaining valuable experience in a well-equipped facility, so I decided to apply for it.

But before I applied for the ASCENT program, I was looking at the application guidelines with excited feeling and also with a feeling of uncertainty as to whether I would be able to do it or not. However, at that time, I decided to take the first step and I applied for the ASCENT program. I was afraid that if I failed, it would become the end of it. It was the biggest challenge I had taken on since I took the junior high school entrance exam. Eventually, I was selected as an ASCENT student, and a new world that I had never experienced before awaited me. I had my first university classroom with wonderful professors, and developed a research plan that was unique to me. And most of all, I was surrounded by friends who had their own fields of interest and passion in learning. I really got a lot of good stimulations. I was able to spend my first year of high school in a truly luxurious environment. I am very glad that I applied for this program at that time. By having courage to take the first step, my life has changed dramatically.

Families and siblings of persons with disabilities

Ito Yuika and Otsuki Yuto

Shumei Yachiyo High school, Japan

Purpose and Background

We can easily understand that disabled children and parents of disabled children are going through a tough time, because they are often featured in Japanese documentaries. However, we thought that in reality, it is not only them, but also "Kyodaiji" (children who have a sibling with a disability) who are suffering.

Through this study, we would like to introduce to you the suffering of "Kyodaiji" that we do not usually pay attention to.

Materials and Methods

We visited a support facility for children with disabilities in Chiba Prefecture to learn more about the problems of their siblings. This facility is a place where disabled children and their parents work together and receive support. With the cooperation of the facility, we asked four parents of autistic children and "Kyoudaiji" who attend the facility to share their stories about their siblings.

Results and Discussion

The episodes we have heard are as follows:

・In the first case, the disabled boy and his older sister visited her friend's house with their parents. While they were there, the boy wet himself. While his mother took him away to clean up, the friend teased the boy's sister about the accident and she felt really hurt.

・In the second case, the family were eating dinner at a restaurant when the disabled child had a tantrum. His older brother realised that his own classmates were in the restaurant too and they saw the whole scene. The classmates didn't know his brother was autistic and the boy could see their surprise. His embarrassment became a painful memory.

・In the third case, the disabled child and his older brother lived together with their father. The father was often busy at work. He came home late most days and had to spend time looking after the disabled son. Consequently, the older brother felt neglected and unloved.

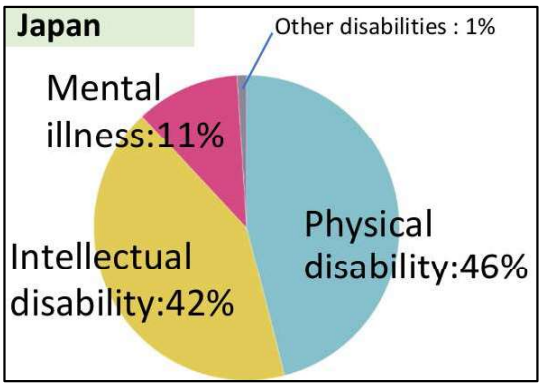
・In the fourth case an elementary school boy took his older sister's sanitary products from the bathroom and unboxed them as part of his play activity. The sister was upset and really embarrassed. Unfortunately, the disabled sibling couldn't understand why such behaviour would cause great stress for his sister.

During the interviews we were surprised at how fantastic these stories were. Therefore we thought that families who cannot get help from support facilities such as the one in Sakura City may have similar problems.

A big charity TV show is broadcast every August in Japan. It often includes segments where people with disabilities can take on and overcome special challenges. The viewers reaction may be to feel moved seeing these pure and righteous people with disabilities, and their families, doing their best in the face of adversity.

However, they may actually despise disabled people and imagine that all such people should lead their lives in a virtuous manner, never doing wrong. But we must accept that disabled people can be lazy or badly behaved too, just like all of us.

Wouldn't it be wonderful if we could accept people with disabilities too, including their good points and bad points.If we could treat people with disabilities as equals, not judging them with prejudice, wouldn't that be wonderful?



Percentage of persons with disabilities by type in Japan. (source: Ministry of He vvalth, Labor and Welfare,Japan)

SDGs Workshop

Purpose of the SDGs workshop

SDGs (Sustainable Development Goals) are important actions to improve and set up a sustainable world. All the seventeen goals raised in the SDGs are critical and urgent issues. We should collaborate to find the direction to solve those issues. However, the causes of those issues are diverse even in the local area, and there is a necessity for collaboration. Therefore, mutual understanding of the causes of the SDGs matters is vital to reach a starting point for cooperation. This workshop is one way to establish comprehension of SDGs among people in Asia.

We hope you, the workshop attendants, will discuss with students from other countries, and make friendship each other. Human network is essential to solving global issues, and this is the opportunity to start building the network.

【 Schedule 】	
14:00-14:10	**Move to Workshop Room (2111, 2207, 2208)**
14:10-15:10	Workshop with High School Students and ASEAN Delegates **Discussion**
15:10-15:50	Workshop with High School Students and ASEAN Delegates **Making a poster**
15:50-16:40	Workshop with High School Students and ASEAN Delegates **Poster Presentation**
16:40-17:00	**Move to Room 2101**
17:00-17:30	Wrap-up･Closing Ceremony
17:30	Photo Session

Members

SDGs Work Shop - Room2111

GroupA		Name	University / School	Country
1	Supervisor	KETSING JEERAWAN	Kasetsart University	Thailand
2	Facilitator	KOOLSRIROJ UDOMLUK	Kasetsart University	Thailand
3	Learner	GANDHI NAPITUPULU	Institut Teknologi Bundung	Indonesia
4	Learner	KANO Masato	Chiba Prefectural Sakuragaoka School for special need education	Japan
5	Learner	ASO Shota	Shiba Gakuen Educational Institution Shiba Senior High School	Japan
6	Learner	MOCHIZUKI Kaho	Ichikawa gakuen Ichikawa Senior High School	Japan
7	Learner	KATO Miyu	Chiba Prefectural Yakuendai High School	Japan
8	Learner	ENOMOTO SAKUMI	Chiba University	Japan

GroupB		Name	University / School	Country
1	Supervisor	SANTIPARP PRASAK	Mahidol University	Thailand
2	Facilitator	NIRAMITCHAINONT POSCHANAN	Mahidol University	Thailand
3	Learner	FEBBY AYU FITRIANI	Universitas Pendidikan Indonesia	Indonesia
4	Learner	SASAKI Nene	Ichikawa gakuen Ichikawa Senior High School	Japan
5	Learner	TAKAHASHI Yuto	Shibaura Institute of Technology Kashiwa Senior High School	Japan
6	Learner	YUI Ryuka	Hiroo Gakuen Senior Hgih School	Japan
7	Learner	OISHI Miyu	Tokyo Metropolitan High School of Science and Technology	Japan
8	Learner	MOROTA AMI	Chiba University	Japan

GroupC		Name	University / School	Country
1	Supervisor	ASSAVARAK PASSANAN	King Mongkut's University of Technology Thonburi	Thailand
2	Facilitator	TAREELAP NAPACHAT	King Mongkut's University of Technology Thonburi	Thailand
3	Learner	MULYADI ALWI	Universitas Gadjah Mada	Indonesia
4	Learner	KATAOKA Kanna	Ichihara Chuo High School	Japan
5	Learner	TAKIUE Fuki	Shibuya Kyoiku Gakuen Shibuya Senior High School	Japan
6	Learner	Nayuni Perumpuliarachchi	UAI International School of Tokyo	Japan
7	Learner	HIRATA Chie	Tokyo Metropolitan High School of Science and Technology	Japan
8	Learner	ONIZAWA MIYU	Chiba University	Japan

GroupD		Name	University / School	Country
1	Supervisor	BOON-ON PATSORN	Silpakorn University	Thailand
2	Facilitator	Siti Nurul Zhahara	Chiba University	Indonesia
3	Learner	SANTOS KATRINA JHOANNE MACOL	University of San Carlos	Philippines
4	Learner	TANAKA Shiori	Shibaura Institute of Technology Kashiwa Senior High School	Japan
5	Learner	OTSUKI Yuna	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan
6	Learner	NAKANO Eko	Tokyo Metropolitan High School of Science and Technology	Japan
7	Learner	HORI SOTA	Chiba University	Japan

GroupE		Name	University / School	Country
1	Supervisor	IVONNE MILICHRISTI RADJAWANE	Institut Teknologi Bundung	Indonesia
2	Facilitator	KARINA APRILIA SUJATMIKO	Institut Teknologi Bundung	Indonesia
3	Learner	TSAI YI-CHEN	National Taiwan Normal University	Taiwan
4	Learner	TAJIMA Hannah	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan
5	Learner	KOJIMA Shiho	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan
6	Learner	FUNAKI Yayoi	Crimson Global Academy	Japan
7	Learner	MASUDA Kei	Tokyo Metropolitan High School of Science and Technology	Japan
8	Learner	NAKAGAWA AOI	Chiba University	Japan

SDGs Work Shop - Room 2208

GroupF		Name	University / School	Country
1	Supervisor	DYAH RAHMAWATI HIZBARON	Universitas Gadjah Mada	Indonesia
2	Facilitator	UTIA SUARMA	Universitas Gadjah Mada	Indonesia
3	Learner	DETHSUPHAR DUANTEMDOUNG	Chulalongkorn University	Thailand
4	Learner	ITO Yuika	Shumei Yachiyo High School	Japan
5	Learner	FUJISAWA Yua	TokyoTech School of Science and Technology	Japan
6	Learner	ARAI Miyuu	Tokyo Metropolitan High School of Science and Technology	Japan
7	Learner	FURUKAWA YUI	Chiba University	Japan

GroupG		Name	University / School	Country
1	Supervisor	AGUS BUONO	IPB University	Indonesia
2	Facilitator	CHANSAENGSEE SOVARITTHON	Mahidol University	Thailand
3	Facilitator	DINA YUNIAR	IPB University	Indonesia
4	Learner	PHAT KOREA	Royal University of Phnom penh	Cambodia
5	Learner	OTSUKI Yuto	Shumei Yachiyo High School	Japan
6	Learner	KOSHIMIZU Miyu	Yachiyo Shoin Senior High School	Japan
7	Learner	KOSHIO Yui	Chiba University	Japan

GroupH		Name	University / School	Country
1	Supervisor	NI KOMANG ARI SAWITRI	Udayana University	Indonesia
2	Facilitator	KATO Chiharu	University of Tokyo	Japan
3	Learner	PACHEJO ROMEL LARUPAY	University of San Carlos	Philippines
4	Learner	SUDO Moeka	Chiba Prefectural Kokubun High School	Japan
5	Learner	AMANO Haruto	Azabu Junior High School	Japan
6	Learner	KANAZAWA Anna	Showa Gakuin Shuei High School	Japan
7	Learner	OSHITA Saho	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan

GroupI		Name	University / School	Country
1	Supervisor	TAGALOG RITA MAY PATINO	University of San Carlos	Philippines
2	Facilitator	JUGAR RICHARD RAMOS	University of San Carlos	Philippines
3	Learner	ALMAS SHABRINA	IPB University	Indonesia
4	Learner	SRIRAKSASIN KAYSINEE	King Mongkut's University of Technology Thonburi	Thailand
5	Learner	OSHITA Saho	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan
6	Learner	FUJII Riku	Suito Kokusai Senior High School	Japan
7	Learner	YABUNOUCHI Hiroki	Chiba Prefectural Kisarazu High School	Japan
8	Learner	KATO ATSUYA	Chiba University	Japan

GroupJ		Name	University / School	Country
1	Supervisor	YEH YI-FEN	National Taiwan Normal University	Taiwan
2	Facilitator	Joceline Theda Kadarman	Chiba University	Indonesia
3	Learner	MARINKOVICH MILANKA	Mahidol University	Thailand
4	Learner	SUNAGA Elisa	Chiba Prefectural Matusdo Kokusai High School	Japan
5	Learner	ADACHI Masanori	St. Mary's International School	Japan
6	Learner	SEKI Tomoaki	Chiba Prefectural Kisarazu High School	Japan
7	Learner	IZUMI SHIZUKA	Chiba University	Japan

GroupK		Name	University / School	Country
1	Supervisor	NGUYEN DUC HUY	VNU University of Education	Vietnam
2	Facilitator	TRAN THI THU HUONG	VNU University of Education	Vietnam
3	Learner	KANITJINDA SUPAWIT	Kasetsart University	Thailand
4	Learner	ANTOLIJAO MIKAYLA ROSELLO	University of San Carlos	Philippines
5	Learner	NAKAJIMA Hina	Chiba Reimei High School	Japan
6	Learner	MOROKAWA Yuna	Senshu University Matsudo High School	Japan
7	Learner	KIKUCHI Takeyoshi	Chiba Prefectural Chiba Technical High School	Japan
8	Learner	MURAKAMI YUMA	Chiba University	Japan

SDGs Work Shop - Room2207

GroupL		Name	University / School	Country
1	Supervisor	RUPAVIJETRA PHETCHAREE	Chiang Mai University	Thailand
2	Facilitator	Brenes Leon Mariana	Chiba University	Costa Rica
3	Learner	KOMANG GEDE PUTRA AIRLANGGA	Udayana University	Indonesia
4	Learner	DANG MINH TUAN	VNU University of Education	Vietnam
5	Learner	ODA Miyou	Reitaku High School	Japan
6	Learner	TANAKA Yuna	Chiba Meitoku High School	Japan
7	Learner	TATEISHI Kaisei	Chiba Prefectural Chiba Technical High School	Japan
8	Learner	SATO HAYATE	Chiba University	Japan

GroupM		Name	University / School	Country
1	Supervisor	KANYASAN KETHSANA	National University of Laos	Laos
2	Facilitator	Borba Gâmbaro Cláudia Maria	Chiba University	Brazil
3	Learner	NGUYEN DUC NGUYEN	VNU University of Education	Vietnam
4	Learner	NAKA Nanako	Reitaku High School	Japan
5	Learner	Yadav Valdes Rajan	Tsukuba Shuei High School	Japan
6	Learner	SHIMOYAMA Yurika	Shibuya Kyoiku Gakuen Shibuya Senior High School	Japan
7	Learner	AKEZUMA Naohiro	Chiba Prefectural Chiba Technical High School	Japan
8	Learner	MARUSAWA KAZUAKI	Chiba University	Japan

GroupN		Name	University / School	Country
1	Supervisor	KITCHAROENPANYA JARUPA	Chulalongkorn University	Thailand
2	Facilitator	COOHAROJANANONE NAGUL	Chulalongkorn University	Thailand
3	Learner	CHEA SOVATHANAK	Royal University of Phnom penh	Cambodia
4	Learner	KAMASUKA Miku	Shibuya Kyoiku Gakuen Makuhari Senior High School	Japan
5	Learner	KAJIWARA Kent	Tokyo Gakugei University International Secondary School	Japan
6	Learner	NAKANO Kotaro	Chiba Prefectural Chiba Higashi High School	Japan
7	Learner	NAKAZATO YUKA	Chiba University	Japan

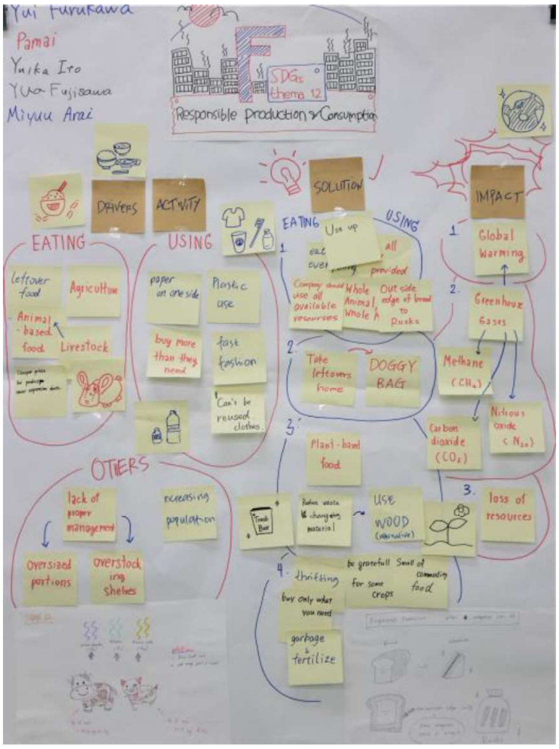
GroupO		Name	University / School	Country
1	Supervisor	JAENGAKSORN NATTHAPOL	Chiang Mai University	Thailand
2	Facilitator	Carvalho Silva Iago	Chiba University	Brazil
3	Facilitator	TOCH PHEAKDEY	Royal University of Phnom penh	Cambodia
4	Learner	ANN BUNKHUOCH	Royal University of Phnom penh	Cambodia
5	Learner	SUZUKI Maya	Chiba Prefectural Matusdo Kokusai High School	Japan
6	Learner	MORITA Hayato	Tokyo Gakugei University International Secondary School	Japan
7	Learner	TSUCHIMOTO Rikuya	Chiba Prefectural Funabashi High School	Japan
8	Learner	NAGAO KENSUKE	Chiba University	Japan

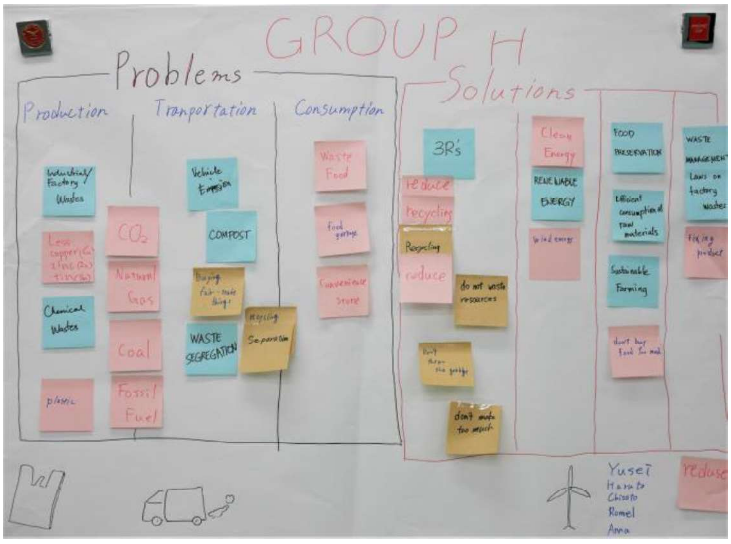
GroupP		Name	University / School	Country
1	Supervisor	IDA KANIAWATI	Universitas Pendidikan Indonesia	Indonesia
2	Facilitator	Hafiz Anshari	Chiba University	Indonesia
3	Learner	LAOWANG PHUCHIT	Chiang Mai University	Thailand
4	Learner	IOCHI Riku	Chiba Reimei High School	Japan
5	Learner	NAGAO Tomo	Keio Girls Senior High School	Japan
6	Learner	ISHIKAWA Mayu	Tokyo Metropolitan High School of Science and Technology	Japan
7	Learner	OTUKA Asuka	Chiba Prefectural Yakuendai High School	Japan
8	Learner	MASE ARINA(ALINA)	Chiba University	Japan

GroupQ		Name	University / School	Country
1	Supervisor	LEKSANSERN ARISARA	Mahidol University	Thailand
2	Facilitator	BAMBANG SULISTYANTARA	IPB University	Indonesia
3	Learner	NGUYEN TUNG LAM	VNU University of Education	Vietnam
4	Learner	NISHIKAWA　Manaka	Ichihara Chuo High School	Japan
5	Learner	TAKAGAKI Minami	Chiba Reimei High School	Japan
6	Learner	KUNIYA Rina	Tokyo City University Todoroki Senior High School	Japan
7	Learner	INABA Chisato	Tokyo Metropolitan High School of Science and Technology	Japan
8	Learner	IWASAKI　HARUNO	Chiba University	Japan

Poster

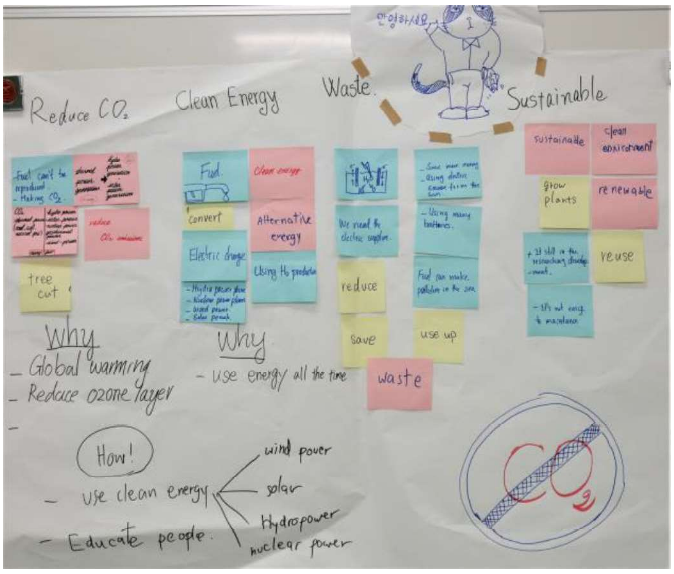

problem
Solution
production
Consumption


Yui Furukawa
Pamai
Yuika Ito
Yua Fujisawa
Miyuu Arai
SDGs theme 12
Responsible Production & Consumption
EATING
USING
DRIVERS
ACTIVITY
SOLUTION
IMPACT
OTHERS


GROUP H
Problems
Production
Tranportation
Consumption
Solutions


SDG 12: Responsible Production & Consumption
Causes
Effects
Solutions & Prevention
Government
Company
Human

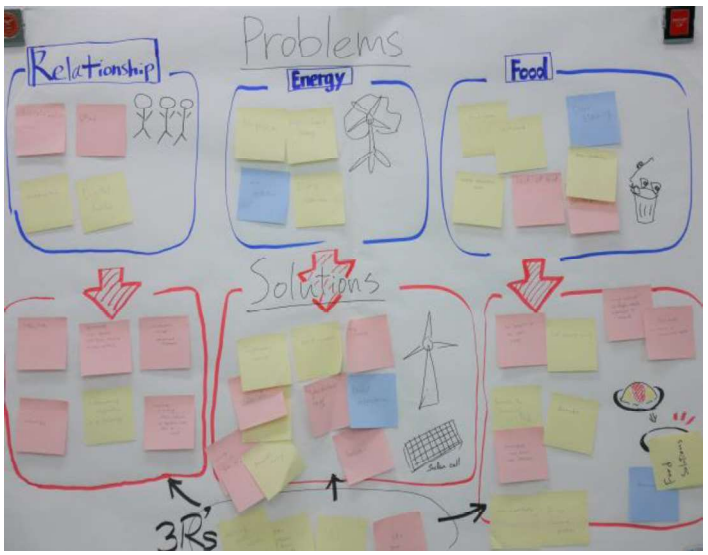

Mass Production
Food
Clothing
Tech
RProduction
RConsumption
THINK
Before You Produce
Before You Consume

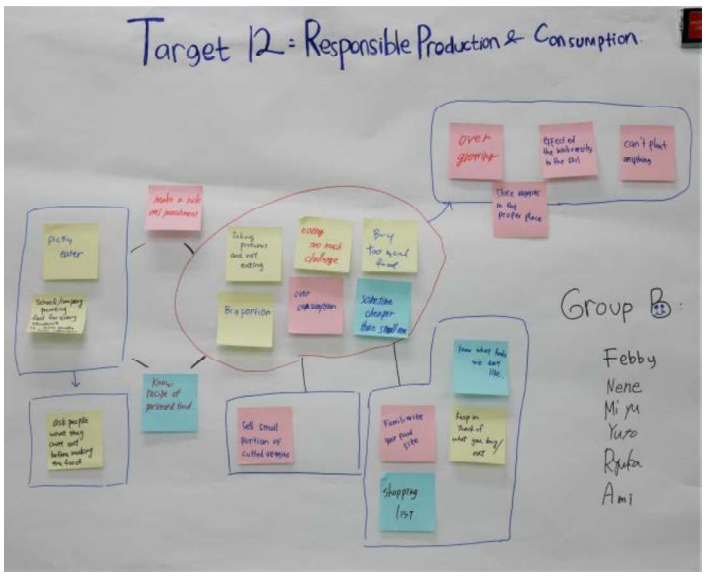

Reduce CO2
Clean Energy
Waste
Sustainable
Why
- Global warming
- Reduce ozone layer
Why
- use energy all the time
How!
- use clean energy
- Educate people
wind power
solar
Hydropower
nuclear power

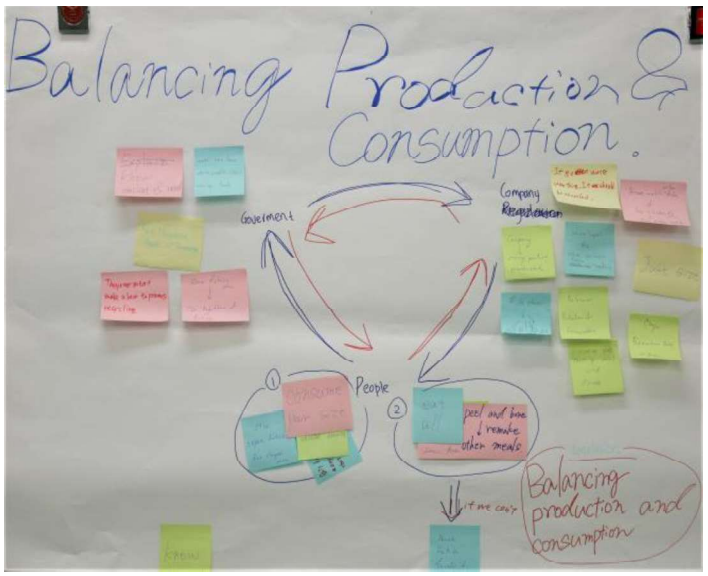

SDGs


Group:
Manaka → leader
Rina
Lam
Haruno
Minami
Food loss
don't buy too much
don't make too much
Budget & planning and cutting
Take as much as you can eat
Use good only when necessary
Change partner
Slogan
Solution
Reuse
Reduce
Anisara
Bambang

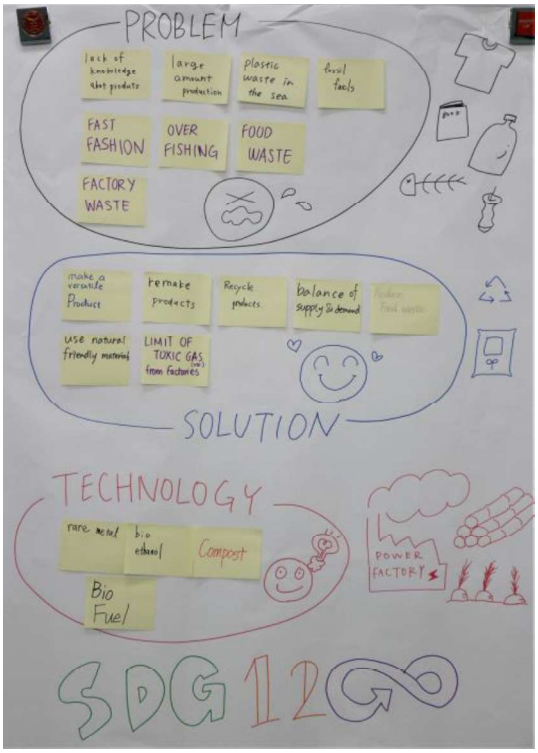

SDGs


Problems
Relationship
Energy
Food
Solutions
3R's

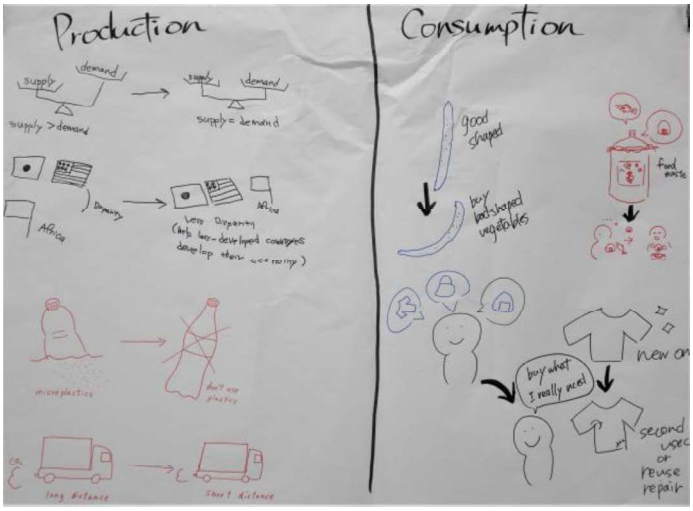

Target 12 = Responsible Production & Consumption
Group B:
Febby
Nene
Mi yu
Yuzo
Ryuta
Ami

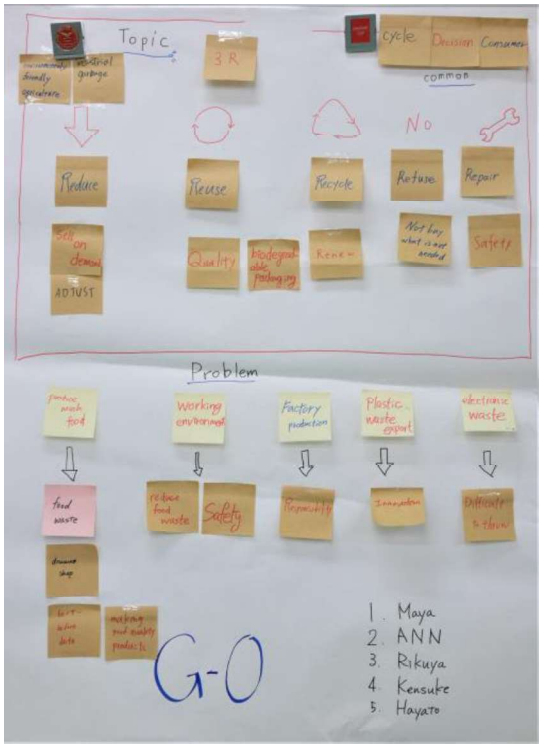

Balancing Production & Consumption.
Government
Company
People
Balancing production and consumption


Responsible Production and Consumption
daily behavior
Government Policies
consuming foods
recycling electronics
buying from local farmers
conscious effort
encourage reusing
cleaning up plates
LCA
Education
educating youth
Group D
SDG 12


PROBLEM
FAST FASHION
OVER FISHING
FOOD WASTE
FACTORY WASTE
SOLUTION
LIMIT OF TOXIC GAS from factories
TECHNOLOGY
Compost
Bio Fuel
POWER FACTORY
SDG 12


SDGs 12.3
Food drive
Check expiray dates often
Don't throw away food which can eat.
Cook only what you can eat.
Sell "bad" product at cheaper prices
Fruit waste is increasing
Non-suitable crops
Better restoration
Choose better equipment
Collaboration between governments & experts
problem
subproblem
solution


Production
Consumption
supply
demand
supply > demand
supply = demand
good shaped
buy bad-shaped vegetables
food waste
buy what I really need
second use or reuse repair
long distance
short distance


Topic
3R
cycle
Decision
Consumer
common
Reduce
Reuse
Recycle
Refuse
Repair
Quality
Safety
ADJUST
Problem
Working environment
Factory production
Plastic waste export
electronic waste
food waste
Safety
G-O
1. Maya
2. ANN
3. Rikuya
4. Kensuke
5. Hayato


12
SDG
Education
Educate customers
Educate Farmers
production
consumption
MAIN GOAL
ZERO waste
gov Rules
Strategy
Tech-based intervention
Supply & Demand
data based
dead line
campaign
food drive
Prediction
upcycling
discount
System Infrastructure
Application
Shorten Distance