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Developing an international cooperation training program for designing sustainable agriculture systems under the climate crisis era

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Abstract The results of the study were found stemically and holistically approached training program improved student's environmental literacy. Students centered curriculum improve student's environmental awareness, knowledge, skill, attitude and participation when the course finished. Place-based learning enlarged students' skills and increased awareness and sensitivity which leaded to see the whole picture. The relationship between philosophy of training center and curriculum made synergy when it had the same goal. The results of the pre and post-test showed that 100 percent of the student's awareness, skill reaches the hight level after the class. On knowledge, 94.12 percent of the students were high level after the class. The comparison of the student's attitudes and participation was higher than before with a statistical significance level of 0.05.

Keywords: Canaan Globle Leadership Center, Environmental awareness, Environmental sills, Environmental attitude, Environmental practice

Introduction

The world continues to face various critical challenges such as: human-induced climate change, the rapid depletion of natural resources, the frequency of natural disasters, the spread of (old and new) infectious diseases, the loss of biodiversity, the violation of human rights, increased poverty, the dependency of our economic systems on continuous growth in consumerism and so forth (UNESCO, 2009) The International Panel on climate change (IPCC) published the special Report on 2018 that the limiting global warming to 1.5 ℃ above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (IPCC, 2021). In

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same year, 15 years old Swedish student, Greta Thunberg, strikes schooling on every Friday for climate action. Her climate strick influence to the whole world and raised up climate crisis literacy. Based on National Public Utilities Council(NPUC) report from 137 countries which have committed to carbon neutrality and confirmed by pledges to the Carbon Neutrality Coalition and recent policy statements by governments. Recently IPCC release Climate change 2021: The Physical science Bassis summary for policymakers. It mentioned that human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5 (IPCC's Fifth Assessment Report). As this climate crisis human-induced, all the human living on earth should change their behavior. As Tibilish Goals of Environmental Education are 1) to foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural area; 2) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; 3) to create new patterns of behavior of individuals, groups, and society as a whole towards the environment. In that reason, this study focuses on develop practical sustainable agriculture training program. For that reason, this study focuses on developing training programs with a holistic approach for the sustainable agricultural system. And it improved and examined with master's degree students of KOICA-YONSEI in community development. Most of the students are belongs to the government and work in (or related) agriculture sector. This curriculum adapted holistic approach, place beased learming, self analysis, and students-centered learning. Qualitative and quantitation research has done. Qualitative research was done with in-dept interview, observed in the filed work and students' reflection on feedback papers. Quantitative research was done by pre and post test on awareness, knowledge, skill, attitude and participation. This research was conducted from 2015 to 2020 on Canaan Global Leadership Centre, Won-ju, South Korea with enrolled Yonsei-Canaan summer session among KOICA–Yonsei master's degree students.

Materials and methods

This study conducted in both qualitative and quantitative research to found out of the develop an international cooperation training curriculum to make sustainable agriculture systems in their home country under the Climate crisis era.

This international cooperation training program has been developed with students' reflection and recommendation between 2016 to 2019 enrolled Yonsei-Canaan summer program, and applied curriculum with enrolled Yonsei-Canaan summer program in 2020. Under COVID-19 lockdown, activities and data gathering was limited. They have more responsibility to work governmental duties. Although small numbers of population on this research but highly important of outputs in future.

- Independent variable: The curriculum development through international development cooperation training program.

- Dependent variable: The learning outcomes through awareness, knowledge, attitudes, skills and participation in activities before and after the class of the Appropriate Farming Technology and Practice curriculum.

Population and samples

Figure 1 shows population and samples who enrolled Yonsei – Canaan Summer program. The population of this study were 86 students who enrolled Yonsei-Canaan summer session from 2016 to 2020. They are coming from 33 different countries. This curriculum was developed by alumni's reflection of the class. Samples are selected by purposive sampling. They are who enrolled Yonsei-Canaan summer program in 2020 seventeen (17) students.

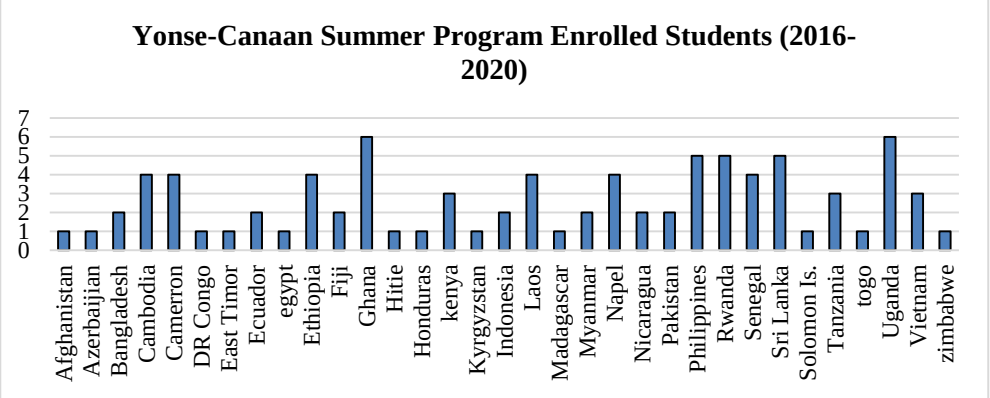

Figure 1. Number of summer program students from 2016 to 2020

Research instruments

In-depth interview schedule. It was designed using guide questions for gathering the needed support data for curriculum development within the group of informants. The quality of the in-depth interview schedules was submitted

and proposing to the advisors and experts to determine the consistency of inquires with the purpose of data collection. Also, the evaluation form for curriculum development was used to gathering data with the level of agreement of alumni who were enrolled and attained in the program as follow: (Roungprapan, 2000).

Scale	Score	Description
4.50-5.00	5	Strongly agree
3.50-4.49	4	Agree
2.50-3.49	3	Moderate agree
1.50-2.49	2	Disagree
1.00-1.49	1	Strongly disagree

The curriculum on the title of Appropriate Farming Technology and Practice was designed based on informats interview data and the related secondary data.

The evaluation/ assessment form for Appropriate Farming Technology and Practice. It was designed with 5 forms as follow: The evaluation/ assessment form of awareness and skill of climate change, sustainable development and sustainable agriculture. Level of students' awareness and skill were rated as follow: (Pimentel, 2019).

Scale	Score	Description
2.34-3.00	11-15	High
1.67-2.33	6-10	Moderate
1.00-1.66	1-5	Low

The evaluation/ assessment form of knowledge, attitudes, and participation of climate change, sustainable development and sustainable agriculture. Level of students' knowledge, attitudes, and participation were rated as follow: (Roungprapan, 2000).

Scale	Score	Description
4.50-5.00	5	Strongly agree
3.50-4.49	4	Agree
2.50-3.49	3	Moderate agree
1.50-2.49	2	Disagree
1.00-1.49	1	Strongly disagree

Program Evaluation/Assessment was follow-up student's project presentation on awareness, knowledge, attitudes, skills, and participation in activities before and after the education. According to the quality of those program evaluation/assessment forms. It was done with the design of the form under advice from advisors and giving to five scholars and experts to assess the consistency of the content with the study objectives. Including giving suggestions for improvement. The researcher was improved the evaluation/

assessment form followed all suggestions and used it for gathering data during program implementation in the year 2020.

Research procedures

The flowchart showed the steps of research process. At the beginning of the study researcher asked students to submit the reflection such as 1) what do you learn from the class? 2) What was impressed? 3) What is your expectation of next class? 4) And anything that you want to say about the class. Student's reflection has been collected since 2016. The researcher sent questionnaire to alumni student who enrolled Yonsei-Canaan summer program from 2016 to 2019 to get how they implement from learning into their work place. And improve curriculum. The developed curriculum was implemented in Yonsei-Canaan summer program in 2020. However, the developed curriculum has been adjusted after students pretest and student's reflection. The assessment of student's environmental ability was done by posttest and evaluate curriculum and also adjusted curriculum undergo Scalars and got suggestions.

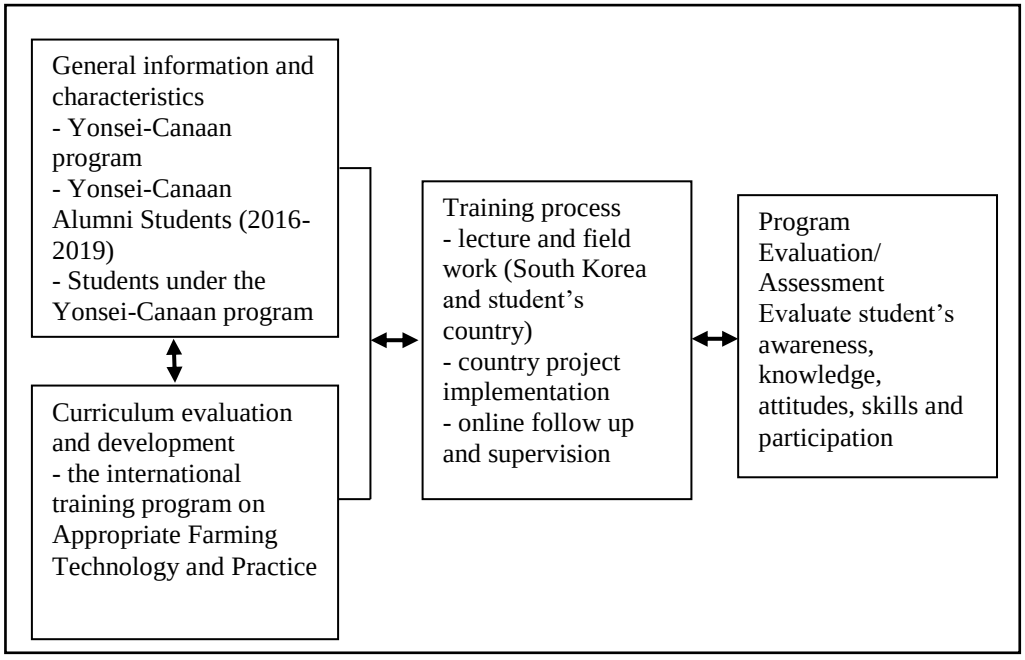

Figure 2. Flowchart of research process

Table 1. Curriculm composition

	Curriculum	Time
1	Introduction to Appopriate farming Technology and Practice (Climate Change and Sustinable development)	4 Hours
2	Introduce Permaculture Design (Ethics and Principles) - Budget analysis on 5 secter (Food, Clothes, Housing, Transportation, Health) oneself - About Seed (Seed market, type of sawing, transplanting, harvesting) - Soil Fertility and make organic fertilizer - Agroforestry (Forest Garden) and Companion plants - Post-harvest (Preserve and Storage) - Marketing (Local food system) - Zoning (To make sustainable life system; Ecovillage network, transition town)	16 Hours
3	Case study: Philosophy of Sufficiency Economy in Thailand	2 Hours
4	Group progect: Design farm, sustainable cloth production and Roadmap to carbon neutral in agriculture	8 Hours
5	Field Practice (Observe, Cleaning the land, Seeding, nursery, mulching, make fertilizer, make rocket stove, potato harvest, make product from the wild plants and daily products)	18 Hours

Data and statistical analysis

For data analysis, the researcher used a computerized ready-made process. The statistics are used to analyze the results as follows: basic statistics are frequency, percentage, mean (Arithmetic mean), Standard Deviation, and t-test (Paired-t-test), the statistics used in the analysis for the quality of the tools are: the content validity and Index of item Objective Congruence (IOC), and Statistics used in hypothesis testing was Paired t-test at the statistical significance level .05.

Results

Systemically and holistically approached training program improved student's environmental literacy

The class started with students free talking on sustinable agriculture and caused unsustainable agriculture. Analysis their opinion was used by Simon Sinek golden circle model (why, how, what and add who). Student's fist thought of sustinable and unsustainable agriculture were responsible by farmer, labor force, and soil depletion. Lecturer tried to show students to how sustainability related personal life style. Lecturer asked students to analyze their person budget into five sections with persentatge. On that section was

analyzed once more on percentage of dependency and independency. Personal budget analysis was collected and get averaged in 4 groups. Result showed that dependency as much higher than independence (Table 2). It showed their agricultural system which consised with producer, consumer and decomposer. But most of the students thought for resposiable on agriculture on producers but not consumers. Once they reconized agricultural system, they started to think deeper to design sustinable agriculture. Concepts of permaculture design (3 ethics, 12 principle and 7 domains), were helped students to design how to sustinable agriculture system. Stduents was practiced to design sustinable cloth product system. With this program, students began to make link between the climate crisis and agricultural society systems.

Students centered curriculum implemented by student's reflection and statement, improve student's awareness, knowledge skill, and attitude and participation after the course finished

Curriculum consisted of lecture, workshop and filed practice. During the workshop, the lecturer observed students' understanding. Fieldwork supported how to implement lectures in practical situations. At the end of the lesson, students wrote and submited their learning status and expection. Then students' comments reflected on next class. The result of pre – post test showed that the student centered education work positively is shown in Table 3.

Table 2. Student's monthly salary analysis and present group average with percentage

v	Food (%)		Cloth (%)		Housing (%)		Health (%)		Transportation (%)	
	Self-sufficiency	dependence	Self-sufficiency	dependence	Self-sufficiency	dependence	Self-sufficiency	dependence	Self-sufficiency	dependence
1	35.00		11.25		28.75		15.00		10.00	
	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
2	32.50		22.50		20.00		11.25		13.75	
	12.50	87.50	47.50	52.5	10.00	90.00	23.75	76.25	6/25	93.75
3	30.00		21.00		20.00		12.00		14.00	
	8.00	92.00	0.00	100.00	40.00	60.00	0.00	100.00	0.00	100.00
4	40.00		18.75		18.75		13.75		8.75	
	60.00	40.00	27.50	72.50	78.75	21.25	17.50	82.50	32.50	67.50

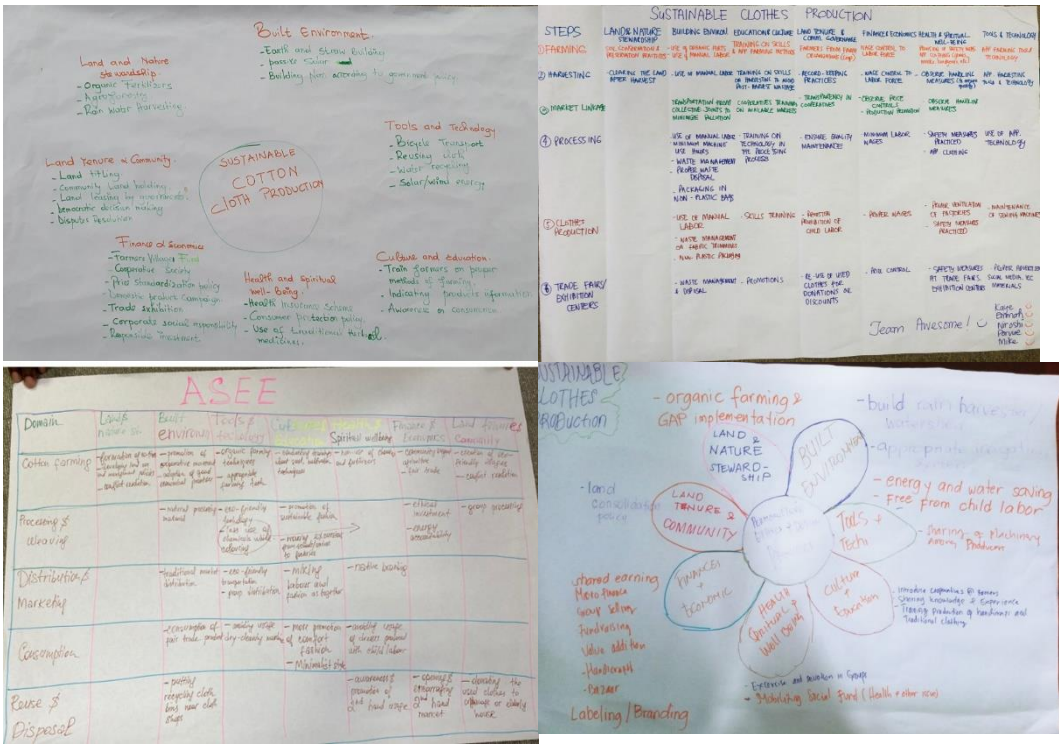

Figure 1. Group presentation of sustainable clothe production

Table 3. Level of student's awareness of climate change, sustainable development and sustainable agriculture according to before enrolled and after enrolled the program

Level of awareness	Before		After	
	Frequency (n=17)	Percentage (%)	Frequency (n=17)	Percentage (%)
Low	6	35.29	0	0
Moderate	11	64.71	0	0
High	17	100.00	17	100.00

Legend:

Scale	Score	Description
2.34-3.00	11-15	High
1.67-2.33	6-10	Moderate
1.00-1.66	1-5	Low

The data of level of student's awareness of climate change, sustainable development, and sustainable agriculture were shown according to before and after enrolled the program, and to answer awareness questions with 1-5 scores

that was low awareness, 6-10 scores were moderate awareness, and 11-15 scores were high awareness (Table 3). This study found that students got a high level of awareness with 100 percentage through after enrolled in the program.

Table 4. A comparison of student's awareness of climate change, sustainable development and sustainable agriculture before and after enrolled the program

Items	n	$\bar{X}$	S.D.	df	t	Sig.
Before	17	10.0588	2.164	16	-6.818	.000*
After	17	13.4706	1.280			

*Statistically significant level at 0.05

A comparison of student's awareness of climate change, sustainable development, and sustainable agriculture before and after enrolled the program is shown in Table 4. Regarding the student's awareness after enrolled the program, it was found to be higher than before with a statistical significance level at 0.05.

Table 5. Level of student's knowledge of climate change, sustainable development and sustainable agriculture according before and after enrolled the program

Level of knowledge	Pre-test/ Before		Post-test/ After	
	Frequency (n=17)	Percentage (%)	Frequency (n=17)	Percentage (%)
Low	1	5.88	0	0
Moderate	12	70.59	1	5.88
High	4	23.53	16	94.12

Legend:

Scale	Score	Description
2.34-3.00	11-15	High
1.67-2.33	6-10	Moderate
1.00-1.66	1-5	Low

The level of student's knowledge of climate change, sustainable development, and sustainable agriculture according to before and after enrolled the program were shown to answer pre-test and post-test with 1-5 scores that showed low level, 6-10 scores were moderate, and 11-15 scores were high (Table 5). This study found that students were a high level of awareness with 94.12 percentage through after enrolled in the program.

Table 6. A comparison of student's knowledge of climate change, sustainable development and sustainable agriculture before and after enrolled the program

Items	n	$\overline{x}$	S.D.	df	t	Sig.
Pre-test/ before	17	8.24	1.751	16	- 4.747	0.000*
Post-test/ after	17	11.71	0.958			

*Statistically significant level at 0.05

A comparison of student's knowledge of climate change, sustainable development, and sustainable agriculture before and after enrolled the program is shown in Table 6. Regarding the student's knowledge after enrolled the program, the students' knowledge using 15 questions of pre-test and post-test for knowledge were evaluated. It was found that students' knowledge was higher than before with a statistical significance level at 0.05.

Table 7. Level of student's skills of climate change, sustainable development and sustainable agriculture according before and after enrolled the program

Level of skill	Before		After	
	Frequency (n=17)	Percentage (%)	Frequency (n=17)	Percentage (%)
Low	2	11.76	0	0
Moderate	4	23.53	0	0
High	11	64.71	17	100.00

Legend:

Scale	Score	Description
2.34-3.00	11-15	High
1.67-2.33	6-10	Moderate
1.00-1.66	1-5	Low

The level of student's skills in climate change, sustainable development, and sustainable agriculture is shown in Table 7. The students' skills using 15 questions of pre-test and post-test for skills evaluation showed that 1-5 scores were low, 6-10 scores were moderate, and 11-15 scores were high. This study found that students at a high level of their skills with 100 percentage after enrolled and attaining the program.

Table 8. A comparison of student's skills of climate change, sustainable development and sustainable agriculture before and after enrolled the program

Items	n	$\overline{x}$	S.D.	df	t	Sig.
Before	17	9.71	3.117	16	- 2.704	0.016*
After	17	14.70	0.469			

*Statistically significant level at 0.05

A comparison of student's skills in climate change, sustainable development, and sustainable agriculture before and after enrolled the program is shown in Table 8. The student's skills after enrolled the program was recorded and the student' skills using 15 questions of pre-test and post-test for skills evaluation found that students' skills after attaining the program was higher than before with a statistical significance level at 0.05.

Table 9. A comparison of student's attitude of climate change, sustainable development and sustainable agriculture before and after enrolled the program

Items	n	$\bar{X}$	S.D.	df	t	Sig.
Before	17	4.07	0.465	16	- 3.949	0.001*
After	17	4.65	0.342			

*Statistically significant level at 0.05

A comparison of student's attitude of climate change, sustainable development and sustainable agriculture before and after enrolled the program is shown in Table 9. The student's attitude after enrolled the program is recorded. The students' attitude using 15 questions of pre-test and post-test for attitude evaluation found that students' attitude after attaining the program was higher than before with a statistical significance level at 0.05.

Table 10. A comparison of student's participation of climate change, sustainable development and sustainable agriculture before and after enrolled the program

Items	n	$\bar{X}$	S.D.	df	t	Sig.
Before	17	3.72	0.632	16	- 7.545	0.000*
After	17	4.47	0.421			

*Statistically significant level at 0.05

A comparison of student's participation of climate change, sustainable development and sustainable agriculture before and after enrolled the program is shown in Table 10. The student's participation after enrolled the program with using 15 questions of pre-test and post-test for participation evaluation found that students' participation after attaining the program was higher than before with a statistical significance level at 0.05.

When the program finished foeCGLC evaluated lectures with five evaluated list as follows: lecture meet the needs of my community, lecture can be applied

to my community, lecture can contribute to economic development in my community, and last if appling knowledge and skill from the lecture. It can be possible sustained the economic growth and most of the students gave high score in five evaluated list. Among five evaluated list reviealed that students gave very high score with the answer of "relevant to the program objectives."

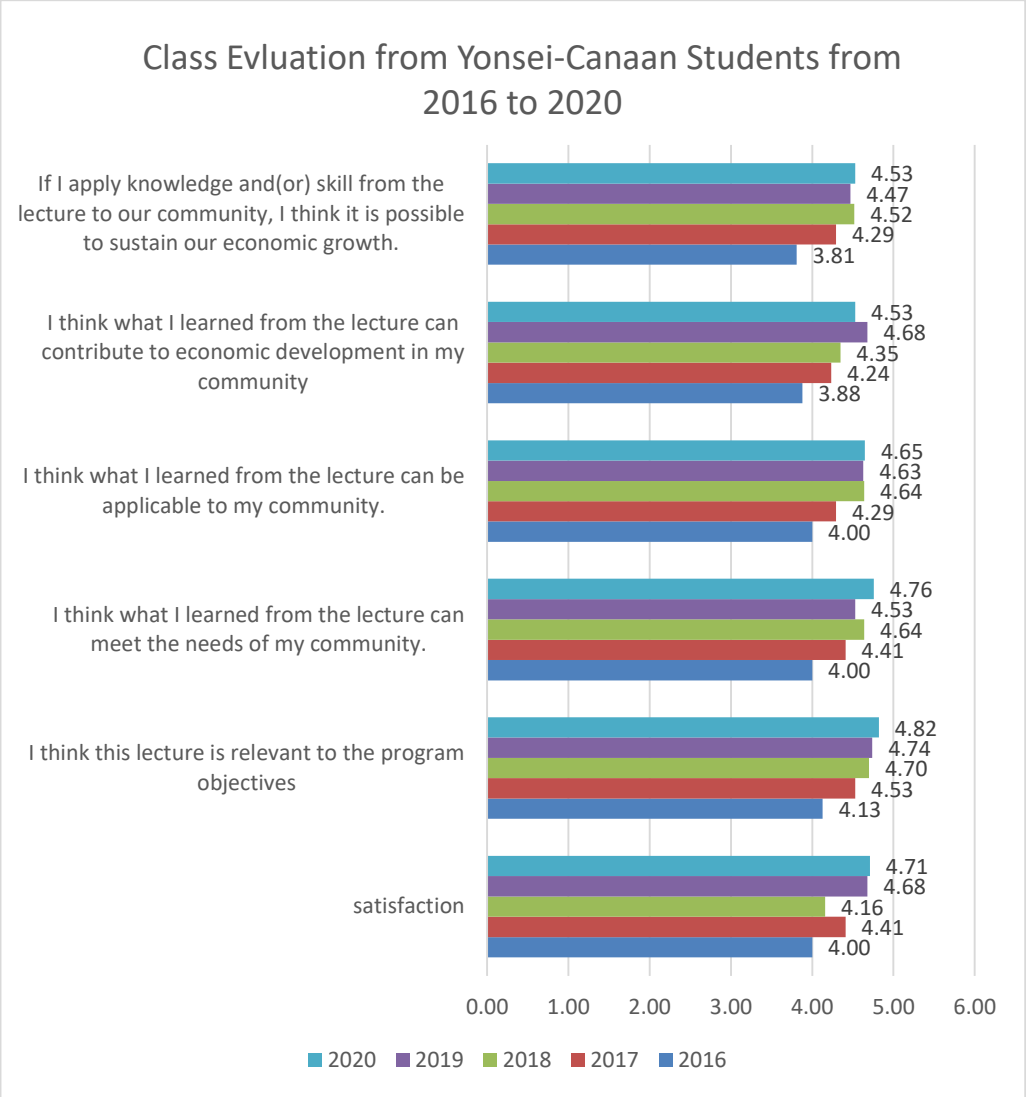

Figure 2. Class evluation from Yonsei-Canaan students from 2016 to 2020

Place-based learning also enlarged students' skills and increase awareness and sensitivity which leads to seeing the whole picture

The filed practice was supported students to understand how theory would work in the filed. Especially, these students came from different countries and environment. Therefore, field practice started with place observation. It let students to design a farm based on observation data. One of the students favorited the field practice which made the wild plants to produce with student's mother countries. Students learned their local wisdom as well as other countries. The aware of the cleaning and healthy environment made to built the wild plant product. In fact, the most of the country, especially developing countres are focused on in high yield rather than environmental sound.

The relationship between philosophy of training center and curriculum can make synergy when it has the same goal

CGLC, traning center, belongs to Canaan Farmers School (CFS) in South Korea. CFS aimed to produce the model communities of poverty eradication based on mindset transformation and to raise leaders. All the traniner should follow their principles. CGLC had three core values - work, service and scarified and three vision- from barren land to fertile soil, from dependence to self-sufficiency and from polluted planet to green earth. With this principle's lifestyle in CGLC are strictly ingrained. Therefore, the curriculum of Appropriate agriculture and practice were stick together with CGLC's principle - and students would learn their four domains - mindset training, lifestyle training, practical training and field trips and theoretical training.

Discussion

Based on the result, students sustainable thinking improved from the beginning of the class. It worked from personal life style analysis. The curriculum consists with personal environmental practice into agricultural sustainable system. Schuler *et al.* (2018), Solovova (2018) and Green *et al.* (2022) mention that systems thinking is regarded as a key competence in the field of education for sustainable development (ESD), because it helped students to understand the complexity and dynamics of natural, social and economic systems. Another factor of the result of student's post test showed in awareness, knowledge, skill, attitude and practice are improved respectily. This

may be because the content of climate change, sustainable development and sustainable agriculture is consistent. Including activities that were performed during the study period, both individually and in groups, consistent with the interests and seriously implemented. Moreover, the practice sessions this research consisted of some suggested projects, tasks and exercises of positive thinking which had the effect of learning like acting and interacting with simulation and guided simulations work even without a clear systematic theory of thinking. The system thinking principles are implicitly communicated in guidelines and monitoring of progress or outcomes of the students who reside in each country after graduating back to their country. These findings are consistent with Forrester (2007) and Sterman (2000) who consider simulation essential for learning systems thinking. It added weight to various initiatives and reported benefits of simulation for environmental learning (Stave, 2010 and Sadalla *et al.*, 2019). This is an important policy implications for ESD. Interm of the filed practice such as farm desige was supported students to understand how theory would work in the filed. Especially, these students came from different countries and environment and changing experiences between each other. This finding consistent with Altieri (2004) conclused in linking ecologists and traditional farmers that lack of ecological guidance, agricultural modernization promotes monocultures, new varieties, and agrochemical packages, all of which are perceived as critical to increasing yields, labor efficiency, and farm incomes. Strong pressures promote the conversion of subsistence agriculture to a cash agricultural economy; as this happens, the loss of biodiversity in many rural societies progresses at an alarming rate. Place-based learning could be a bridge to understand between natural ecosystem, agroecosystem, and human ecosystem for sustinable development. It expanded students' awareness of concept of sustinable agriculture system. In the same word, place based learning enlarged sudent's skills as well as system thinking. These findings are in line with the relationship between philosophy of training center and curriculum can make synergy when it has the same goal with three core values - work, service and scarified and three vision- from barren land to fertile soil, from dependence to self-sufficiency and from polluted planet to green earth with follow the gobal sustanability and happness of Human in the end (Poungsuk, 2020). So, that the principle's lifestyle in CGLC are strictly ingrained. Therefore, the curriculum of appropriate agriculture and practice were stick together with CGLC's principle - and students would learn their four domains - mindset training, lifestyle training, practical training and field trips and theoretical training.

Suggestion for further research that the curriculum is needed to add more highlight “End Poverty” the SDGS No 2 in carbon neutral social system. Also revise or adjust this curriculum for various ages, institution and program. Consquesntly, the curriculum could be more usful for any country to build up sustainable agriclutre. Furthermore, follow up Yonsei-Canaan alumni’s practice in their nation. The collection of their practice shared their works with others. The exchange ideas and diffculties kept partnerships and found the solutions for achieving SDGs.

References

Altieri, M. A. (2004). Linking ecologist and traditional farmers in the search for sustainable agriculture. Frontiers in Ecology and the Environment, 2:35-42.

Forrester, J. W. (2007). System dynamics-A personal view of the first fifty years. System Dynamics Review, 23:345-358.

Green, C., Molloy, O. and Duggan, J. (2022). An Empirical Study of theImpact of Systems Thinking and Simulation on Sustainability Education. Sustainability, 14:394; https://doi.org/10.3390/su14010394.

IPCC (2021). Climate change 2021: The Physical Seience Basis Summary for the olicymakers. Working Group, I Contribution to the Sixth assessment Report of the International Panel on climate Change, pp.10.

Poungsuk, P. (2020). Sustainable Agriculture Development for Future Human Security. Proceedings of A model of International Conference in Agricultural Technology (MICAT) 19 November 2020 at Green building, Faculty of Agriculrural Technology, KMITL, Ladkrabang, Bangkok, Thailand.

Sadalla, E., Ledlow, S. and Guhathakurta, S. (2019). I-6 Using System Dynamics Models of the Environment to Teach Sustainability Science: The Border+ 20 Model as a Pedagogical Device. ResearchGate: Berlin, Germany.

Schuler, S., Fanta, D., Rosenkraenzer, F. and Riess, W. (2018). Systems thinking within the scope of education for sustainable development (ESD) – a heuristic competence model as a basis for (science) teacher education. *Journal of Geography in Higher Education*. 42:192-204.

Solovova, N. V. (2018) Realization of Student-Centered Approach in Learning Environmental Knowledge, Ekoloji. 27:2095-2104.

Stave, K. (2010). Participatory system dynamics modeling for sustainable environmental management: Observations from four cases. *Sustainability*. 2:2762-2784; https://doi.org/10.3390/su2092762.

Sterman, J. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Irwin/McGraw-Hill: Boston, MA, USA.

UNESCO (2009). Review of contexts and Structures for Education for sustainable evelopment 2009. Document code: ED.2009/WS/41. pp.80.
NPUC (2021) Carbon Newutral Goal by Country Carbon Neutral Goals by Country - Motive Power (motive-power.com)

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