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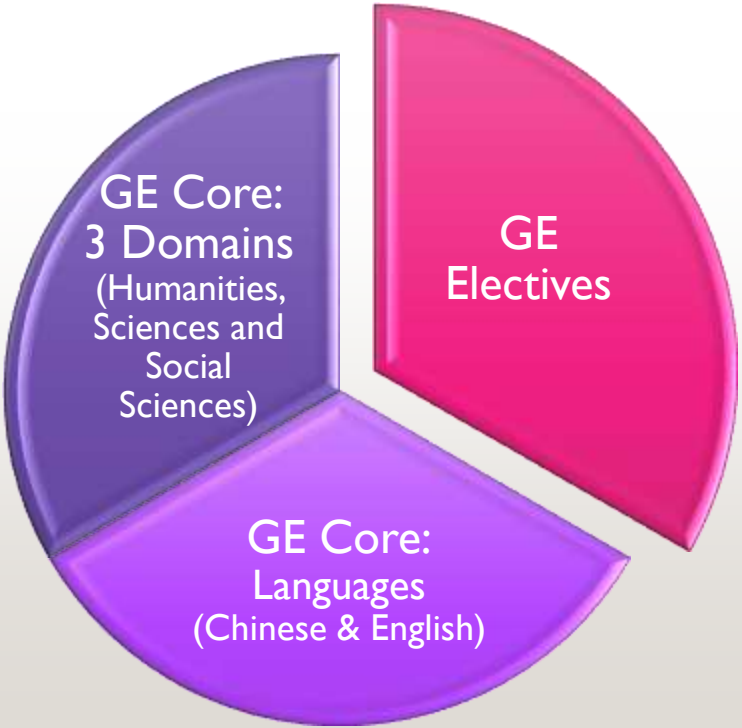
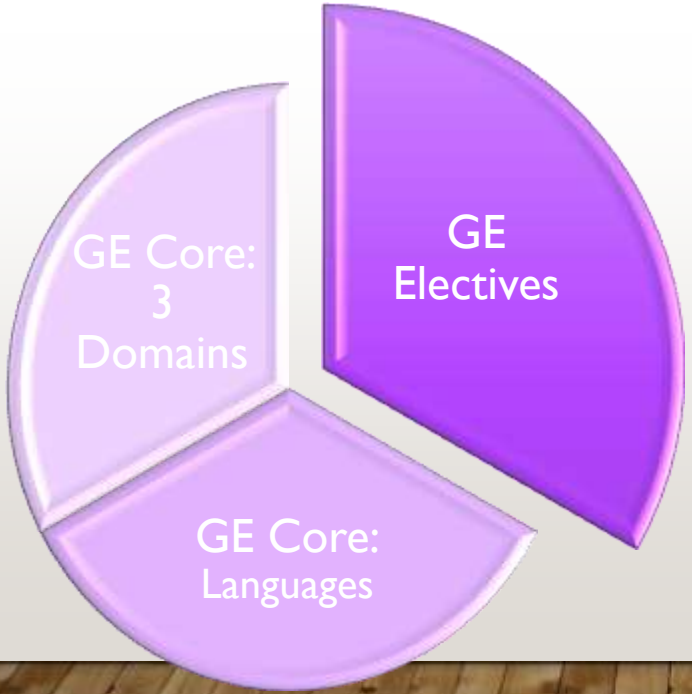
LEARNING BY EXPERIENCING –

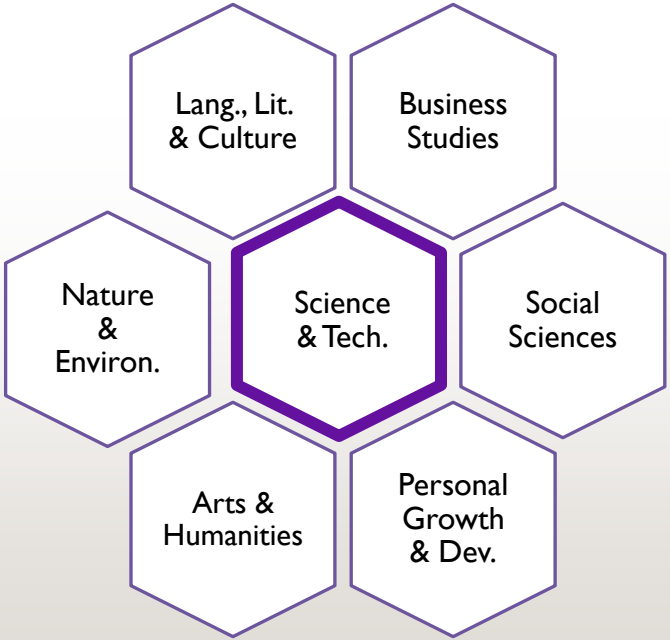
THE MAKING OF CITIZEN SCIENTISTS

THEI GE CURRICULUM



GEE SUB-DOMAINS



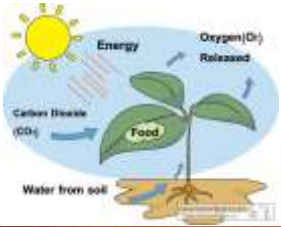


PLANTS & HUMAN CIVILISATIONS

- In general, students' understand on plants is limited to its primitive usage: photosynthesis (food and oxygen), fiber (clothing), etc.
- A holistic view with world vision will be needed to fully unveil the role of plants
- Critical analysis on the role of plants as single most influential factor in:
  - Making us human beings
  - Dominating rise and fall of civilisations
  - Continuity of human societies

AREAS OF INTEREST

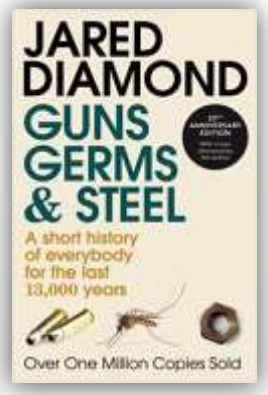
- Plants as our green friends
  (Fundamental sciences)
- Seed of change – plants that changed the course of human history
  (History, from a storytelling approach)
- Seed of culture – plants that shaped the cultures of civilizations
  (A scientific reflection of life)
- Seed of future – How plants continue to boost mankind transformation
  (A glimpse into the future)



OUR SCOPE & PERSPECTIVES

10,000 B.C. 1492 A.D. Present Future (Space Age)

TEACHING & LEARNING ACTIVITIES

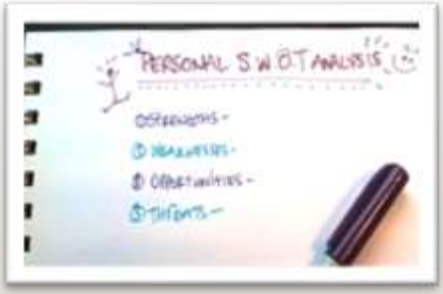


Readings

Documentaries / Movies

Field trip / Site Visit

Group Discussion



Self-reflection exercise

Experiments!

AIM OF PLANTATION EXPERIMENT

- Understand plants development with real experience with plants
  - E.g., seed germination, root and shoot differentiation and development, stem cells, flowering and seed formation, etc.)

Pea colour and Mendel's genetics

- Analyse how agriculture have driven the evolution of human civilisations
  - Analysis of plant growth and harvest by correlation with abiotic and biotic factors
  - Growing plants instrumental to human civilisations enhance their achievement of module ILOs
  - Develop the habits of scientific mindset and participate in the citizen scientists project

Famers in the semester,
Citizen scientists in the future

PLANTATION EXPERIMENTS

Basil

Shallot

Lettuce

Pea

Radish

Plantation Protocols

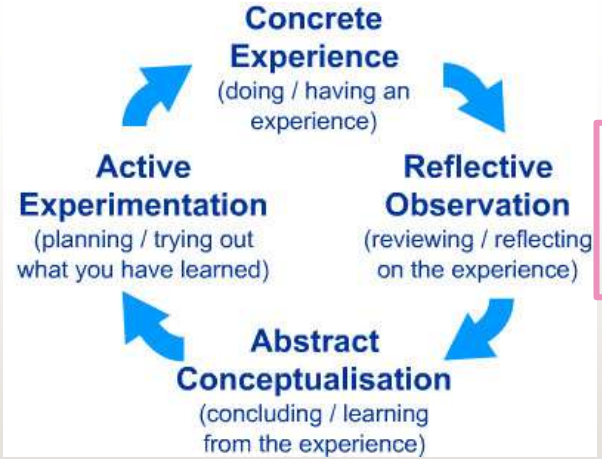
Grow and observation

Data collection & analysis

Laboratory Report

EXPERIENTIAL LEARNING CYCLE

Observation and working as described in the protocol / improvement as discussed with group members. Measure growth parameters



(3-min verbal presentation to the whole class/group/week)

Comparison with past data and with other groups – spotting strength and weaknesses

Experimentation with new pest control strategies / setting up green house / auto-irrigation system

Problem-solving: improvement as reasoned from L&T materials, discussion and make improvement / new suggestions!

STAGES OF PLANTS

Day 10

Day 25

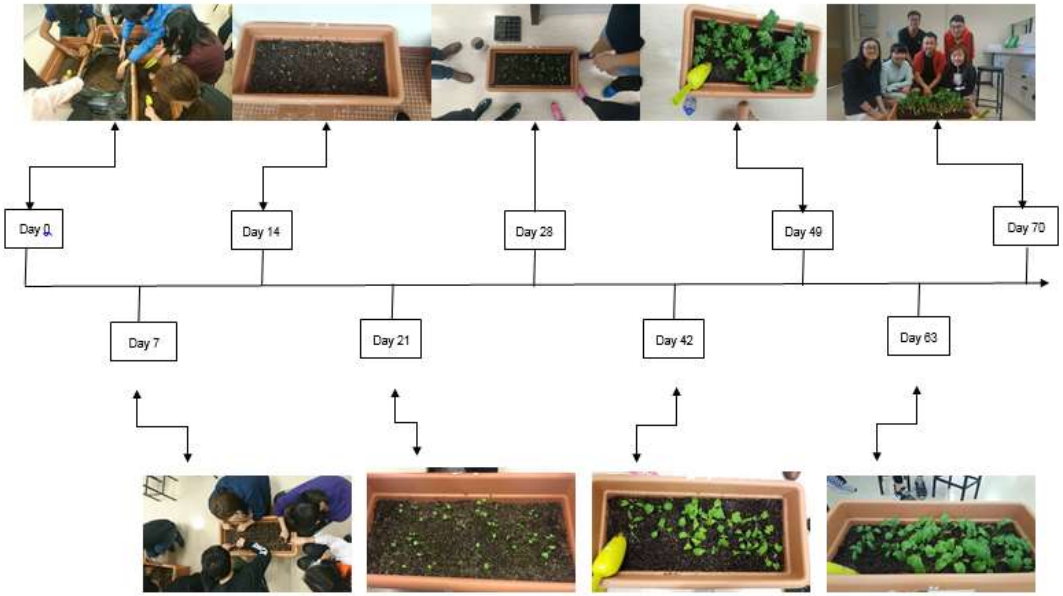
Day 42

Day 70

Observation of plants growth
+ Plant Biology Explained
+ Biometric data measurement

TIMELINE

Plantation Timeline



DATA ANALYSIS

1.4 Photo diary of plant growth

12/2		The seed is germinated.
17/2		Processing the photosynthesis, the buds grew to the sunlight direction which is the conservation of energy to food.
3/3		The interspecific competition can be observed. The leaves competed to overlap the other.
24/3		After removing weak and poor buds, there are more area for the growth. Less buds can guarantee the nutrient can deliver to the healthy one.
7/4		The competition makes the leaves overlap and disturb the growth. We use tools to stand them up and keep the growing direction.

2.3 Growth Rate (Day 21 to Day 70)

2.3.1 Height:

Growth Height (Day 21 – Day 70)

	Day 21 (28/2)			Day 25 (4/3)		
	No. of seedlings	Averaged height (cm)	Standard Deviation	No. of seedlings	Averaged height (cm)	Standard Deviation
	28	1.3	0.5312	27	1.1556	0.5747

	Day 28 (7/3)			Day 31 (10/3)		
	No. of seedlings	Averaged height (cm)	Standard Deviation	No. of seedlings	Averaged height (cm)	Standard Deviation
	17	1.6	0.5123	17	2.0059	0.7093

	Day 42 (21/3)			Day 49 (28/3)		
	No. of seedlings	Averaged height (cm)	Standard Deviation	No. of seedlings	Averaged height (cm)	Standard Deviation
	14	2.1714	0.4937	14	2.6429	0.4033

	Day 63 (11/4)			Day 70 (18/4)		
	No. of seedlings	Averaged height (cm)	Standard Deviation	No. of seedlings	Averaged height (cm)	Standard Deviation
	14	3.2214	0.4694	14	3.5429	0.4910

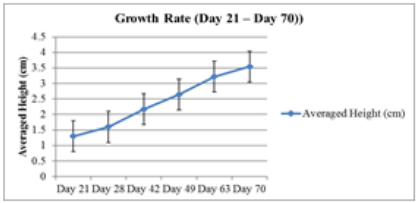


Figure 2: Growth Rate (Day 21 – Day 70)

Through trial and error, and knowledge learned in the module…

Due to the cold weather during the first three weeks of February and the basil seeds needing a temperature of 20-25ºC to optimally grow, we put plastic bags over the planter to reduce heat loss during the day and night. On the 15th February 2017, due to a persistent cold weather (average temperature is below 20ºC), the seeds still have not germinated. We used plastic bags covering the pot in order to form a simple greenhouse and provide a more suitable growing atmosphere for the basil. Photo are taken by Kaeden, Tracy, Samuel,

EXPERIENTIAL LEARNING

Students used their ingenuity to overcome the cold weather and enhance the germination rate of Basil

AUTO-IRRIGATION SYSTEM

Environmental Engineers of the auto-irrigation system
(Water tank was too heavy for transportation, so the students have detached the tank before transporting the pot to the lab for measuring growth parameters)

Pipeline for the auto-irrigation system

PEA GROWING FRAME







JOY OF HARVEST

JOY OF HARVEST

STUDENTS' FEEDBACK

- Students rated the module very positive in SFQ Qs
  - Overall learning experience 8.21/10 cf. institute average 7.52/10

- Opened-ended feedback:
  - "Very board and interesting, deep and full of details."
  - "It has covered a wide range of knowledge related to plants & civilization, and link two part closely together"
  - "Planting activities are fun, Engineering student didn't try it before."
  - "Visual aids and powerpoint slides are great. The use of touching real plants is interesting."

THANK YOU !

EXTRA SLIDES

GEE PROGRAM ILO

- Demonstrate a capacity for critical thinking, self-reflection, and analysis;
- Recognise ethically, socially and globally responsible action;
- Engage in self-directed learning;
- Demonstrate effective oral and written communication skills;
- Engage in creative problem-solving;
- Demonstrate interpersonal skills associated with leadership and teamwork; and
- Apply the broad principles of the Humanities, Sciences, and Social Sciences to practical problems and contemporary issues.