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Project Based Learning Horticultural Course at Faculty of Agriculture, Andalas University

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ABSTRACT

The subject of advanced Horticulture Production Technology is one of the elective subjects at the Agro-technology Study Program. The achievement of this subject is that the students are able to apply agronomy, plant breeding, plant protection, soil science, and social sciences oriented to effectiveness, efficiency, quality, and sustainability of resources by good agricultural practices on various tropical horticultural commodities consisting of vegetables, ornamental plants, medicines, spices, and fruit plants. The subtopic of the project is commodity, morphology, plant condition, plant varieties, and plant cultivation technique prospects. One of the methods used to achieve the learnability mentioned above is the project based learning (PjBL). The steps of PjBL method are setting up the project planning, and time schedule; the of learner characteristic analyses; guided questions for experimental design; monitor progress reports, brainstorming and evaluation of this project. Student's learnability motivation is calculated based upon several indicators such as the student's seriousness in concentrating on the lecture given, both concentration and participation in brainstorming. The result showed that the brainstorming PjBL stimulated a positive response to the learnability. The field experiment might increase both student's knowledge and ability in cultivating various horticulture plants.

Keywords: *Project Based Learning, Horticulture Course*

1. INTRODUCTION

The subject of Advanced Horticulture Production Technology is one of the elective subjects at the Agro-technology Study Program at Faculty of Agriculture offered at Semester V. Its contribution to the graduation competence is defined in the graduation learnability achievement of the Agro-technology study program as follows (1) The students are able to collaborate and have a social sensitiveness and both social and environmental concerns; (2) The students comprehend both theoretical concepts, and knowledge of cultivation technology, science and technology of planting media, science and environmental technology, and wet tropical plant production technology sustainably; (3) The students are able to practice logical, critical, systematic, and innovative thinking within the context of promoting or implementing science, knowledge, and technology concentrating on and implementing value of humanity according to his/her field of discipline; (4) The students are able to show qualified, and measurable self-dependent performance independent; (5) The students are able to practice the science of agronomy, plant breeding, plant protection, soil, and social sciences oriented effective, efficient, qualified, and sustainable resources according to a good agricultural practice [1].

This subject discusses various tropical areas horticultural commodities as vegetables, ornamental plants, medical and herbal plants as well as fruits. Preferably, such plants are both student accessible and harvestable in a short time so that they can practice them by themselves at their respective domicile. The subtopic of the subject is oriented to commodity, morphology, growing condition, plant varieties, and particular cultivation technique (seeding, soil preparing, planting, maintaining, fertilizing, controlling herbicide and plant disease, harvesting, and multiplication system) prospects.

Based upon the learnability above, therefore, the learnability method in the subject of Advanced Horticulture Production Technology (AHPT) prior to last two years emphasizing more on course material delivering through a contact hour, student presentation, and lecture elaboration, and as well as evaluation emphasizing it more in the Middle Semester, Final Semester Tests, Individual Assignment, and Self-Task, and Group Task is considered inappropriate anymore. To cultivate one or two commodities in person or without group and without experimental design as well as without brainstorming develop less student's ability.

During the last two years, in step with the application of on-line learning daring, the students were asked to have on line learning or work from home, thus, both group discussion and presentation were disrupted. Such constraints were entirely technical such as blackout bringing about hotspot to disappear or networking difficulty, lack of phone credit, and noise surrounding the student cause inconvenience during the on-line learning. The other problems found among most of the students are their inabilities to focus on taking part the learning process done through zoom platform.

Based upon the observation during the lecturing using zoom facility, the lectures came across a difficulty to be able to draw both student's interest and motivation to be active either in learning process and discussion. A too frequent and long use of use of zoom each day even indicated as an instigating factor to cause them to come about. The low focus of the student's made the assessment used so far improper. Therefore, expectedly, this Project Based Learning (PBL), the student would be more interested and motivated, not feeling too much under stress due to technical difficulty and are able to build up sprit of entrepreneurship.

The PjBL is one of model learning using a project (activity) as the core of learning [2]. At the PBL learning, the students are required to make a project focusing upon the product development of performance show in which the students do a study or a research, solve the problem, and synthesize the information [3]. The last output of the learning is a product in form of the result of the student's group work [4].

2. METHOD

The PjBL was done in the condition of on-line to the students of semester V Agro-technology Study Program in 2021/2022 taking the subject of advanced horticultural production technology at class C whose number was as many as 31 students. The PjBL activity made use of numerous digital information media such as Unand's Ilearn, Zoom, WhatsApp Group and Google Classroom. The identity information was acquired from preliminary questionnaire. The evaluation of each PjBL gradual activity was obtained from questionnaire, brainstorming and assigning as well as observation through an ilearn report media on agricultural Faculty of Andalas University.

3. PjBL LECTURE IMPLEMENTATION ON ADVANCED HORTICULTURAL PRODUCTION TECHNOLOGY

The Project-Based Learning approach supported by constructive learning theory based upon the idea that the students build up their own knowledge within the context of their own experiences. The Project-Based approach Learning might be viewed as one of learning environmental creation that could boost the students to construct both knowledge and skill personally. The projected approach is done in a collaborative learning modus that is collaborative learning in a small group of students, this approach also gains theoretical support sourced from Vygotsky's social constructivism underlying the cognitive development through intensifying an inter-personal interaction. The availability of delivering ideas, hearing somebody else's ideas, reflecting one's own ideas to the other's is one forms of the individual empowerment experience. Based upon the theoretical perspectives, the project based approach give us authentic learning environment alternatives in which the lectures ease students to promote their skills at work and to solve the problem collaboratively [5].

The learning processes in the Project based learning was developed by The George Lucas Educational Foundation (2005) in Al-Tabany (2017, p.p. 52) consisted of several steps namely: 1) Starting with essential question); 2) Designing a plan for the Project; 3) Creating a schedule; 4) Monitoring the student and the progress of the Project; 5) Assessing the outcome); 6) Evaluating the experience [6].

The teaching staffs need to plan the competence standard to be discussed when discussing problems. Preferably, the competence discussed comprises the important concepts in the curriculum. The teaching staffs have to involve the students in asking questions, making a plan, and completing the activity plan of project/work making. Such an activity involves both teaching staffs and students in making a note exchange supporting the enquiry to solve the problem.

3.1. Design a Plan for The Project and Time Schedule

The subject development of Advanced Horticulture Production Technology (AHPT) under the method of PjBLis truly relevant for the students taking this subject are expected to be able to practice the science of agronomy, plant breeding, plant protection, soil and social sciences oriented to effectiveness, efficiency,

quality, and resource sustainability according to a good agricultural practice (KK1).

In this respect, the students have to be able to yield the product in forms of five main tropical commodities namely 1) The vegetable commodities consisting of a) fruit vegetable of Solanaceae family, b) leaf vegetable of Brasicaceae family, c) bulb vegetable of Liliaceae family. 2) Fruit commodities by artificial vegetative multiplication; 3) Spicy commodities of Zingiberaceae family, 4) Woody ornamental commodity group 5) Medical plant group. In step with the production process, thus, the students will learn about the commodity detail inside out and learn how to cultivate the commodity as well as how to solve the problems faced during the cultivation process.

In attempting the purpose achievement above, thus, the PjBL team of Advanced Horticulture held a meeting in order to plan how to technically hold the PjBL lecture. Wena (2009) elaborated the planning steps of learning covering the activity to define the projected purpose; to analyse the student characteristic; to define the learning strategy; to handle the job-sheet; to design the need of learning source; and to design the evaluating tool [7]. After having PjBl model, the projected procedure as well as the time attained, thus, the team re-discussed them with the students in order to elaborate the picture of the project and to receive the input. The consent is obtained from the discussion result that the project done by the students as well as the arrangement of activity schedule is in step with the Figure 1 below.

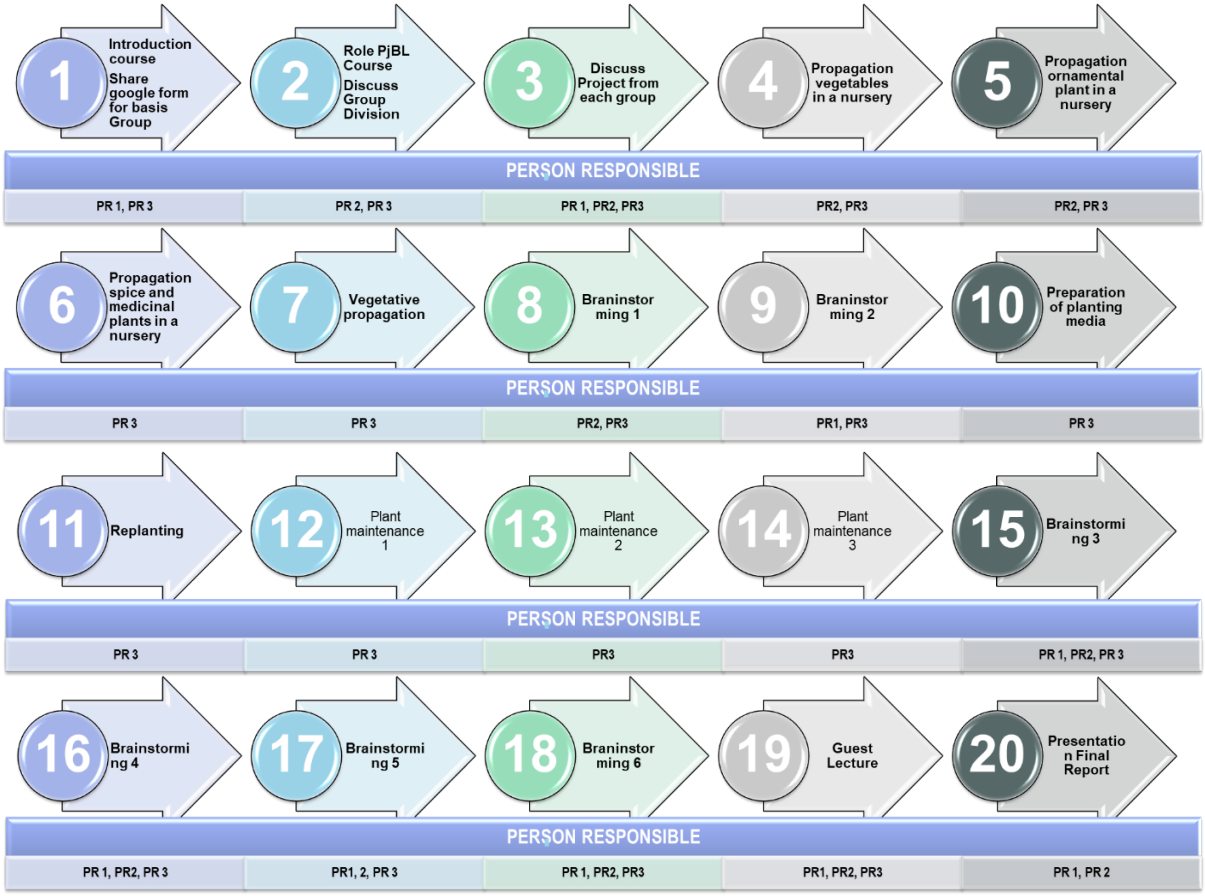

Figure 1. Time Schedule of PjBL Course

3.2. Analyzing the Student's Characteristic

The success of PjBl project at the subject of the Advanced Horticulture is very much supported by the available resources either inside the group or the ones outside group such as location of domicile, land availability, location altitude, and the availability of seed at the location concerned Figure 2. Each plant needs a special growth requirement, there is a plant good for low-land and there is does not suits for it. The activity of a vegetative multiplication is done to the annual plant available at student's neighbourhood domicile. When there is a regional endemic plant, thus, the team will suggest more that the student learn how to cultivate. Therefore, the PjBl team must design an enquiry containing information above.

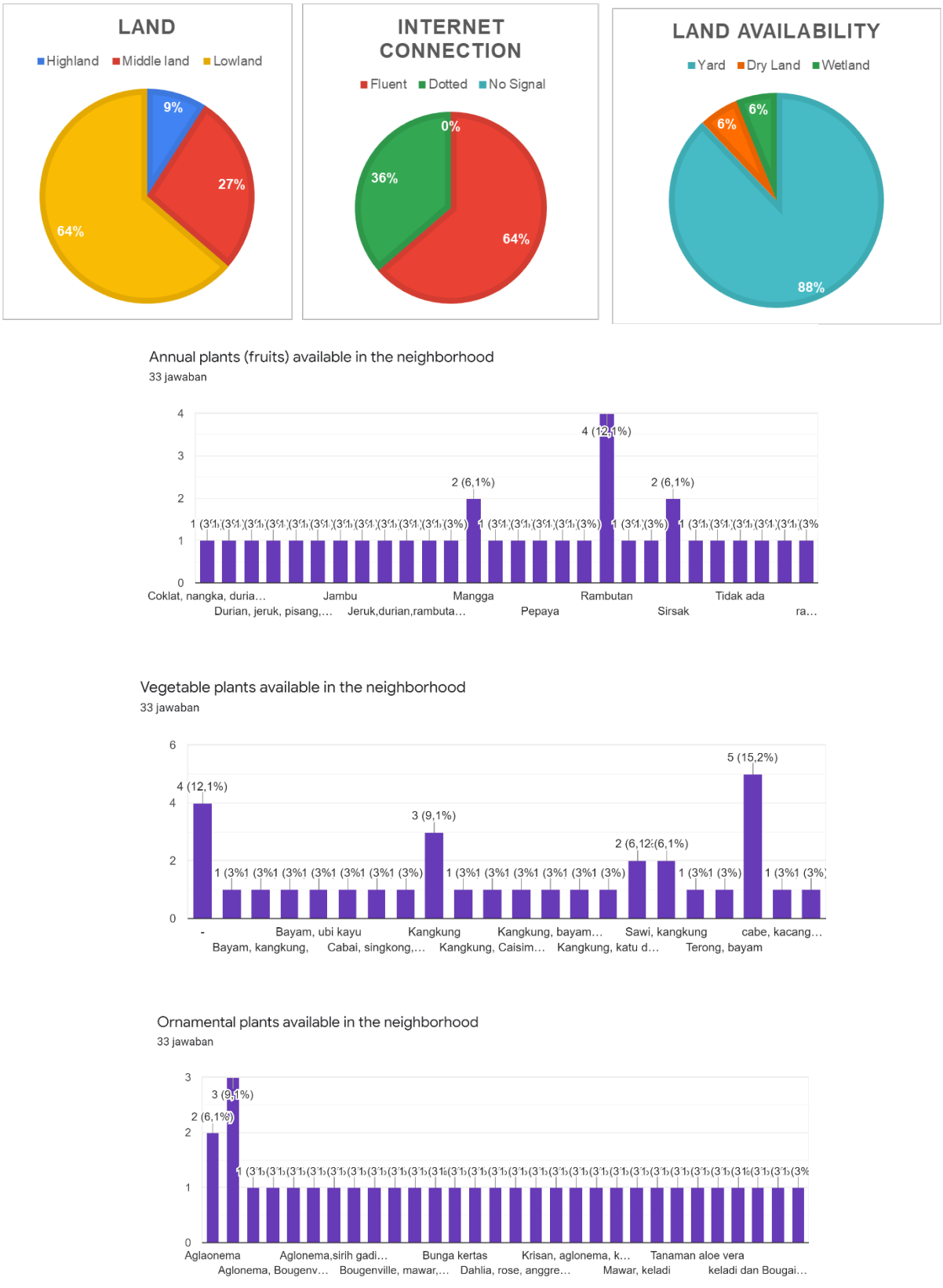

Figure 2. Student Characteristic

The questionnaire filled up by the student is shown in Figure 2. To find out the location altitude, thus, we make use of Google Earth. The questionnaire is evaluated by the teaching team together with the student so that the group division could be found as well as the commodity planted fits the students concerned condition (Figure 3).

KELP.	NAMA/NIM	TANAMAN	DAERAH	DATARAN
1	Siti Rahmah / 1910211015	Cabai merah, sawi, kacang koro, anggrek, cangkok, ketumbar	Padang	Rendah
	Ghifron Ardana/1910211030		Padang	
	Alvin Dwi Julianda/1910211035		Padang	
2	Toti Pradana Wilarsa / 1910213009	Cabai merah, sawi, kacang koro, anggrek, cangkok, ketumbar	Padang	Rendah
	Muhammad Ariq / 1910213011		Padang	
	Pancolo Agung Nur Pamuji/1910211005		Padang	
	Elni Febra 1910211064		Palembang	
3	Resti Hayati/1910211016	Cabai merah, Caisim, kacang koro, anggrek, cangkok, ketumbar	Padang	Rendah
	Exsia Ulina Debora		Padang	
	Ony Tri Wahyuni/1910212009		Padang	
	Indah fadhila zikri/1910212015		Padang	
4	Azzikril Hakim/1910211047	Terung, Semangka, Kacang Panjang, Anggrek, Sambung, Binahong	Padang Pariaman	Rendah
	Mutiara Ihsani / 1910211010		Pariaman	
	M. Surya Ramadhana Gusra / 1910213016		Pariaman	
	Linda Putri Yanti/1910212004		Padang Pariaman	
5	Radiatul Adawiyah 1910211022	Terung, Caisim, Buncis, Anggrek, Sambung, Binahong	Pasaman	Rendah
	Ashylla Kurnia Putri/1910213029		Jambi	
	Rani/1910212047		Pasaman Barat	
6	Siska amelia/1910211945	Kentang, Kembang kol, bawang putih lumbu hijau, krisan potong, tempel, rosella	Pasaman	Tinggi
	Mhd. Mishbah as Shiddiq/1910212055		Agam	
	Siski Rahma Novita/1910213023		Solok	
7	SYNDI LUCIARTA/1910211023	Paprika, Kubis crop, kacang panjang, anggrek, cangkok, kunir/kunyit putih	Solok Selatan	Menengah
	Yosi purnama sari / 1910211033		Solok	
	Ali Rahman/1910212008		Solok	
8	Vannisa Warman/1910213005	Cabai rawit, mentimun, kacang koro, anggrek, sambung … jeruk (pasir pangarayan), ketumbar	Tanggerang	Rendah
	Hervina Ageng Putri/1910212056		Riau	
	Dian Novi Sahfitri/1910211056		Riau	
9	Nur Isna Rahmanti/1910212005	Cabai rawit, mentimun, kacang koro, anggrek, sambung, ketumbar	Agam	Rendah
	Fikhri Taufikur Rahman/1910211050		Pariaman	
	Nurullita Aisyah/1910211028		Pesisir Selatan	
10	SESWITA/1910211025	Paprika, Labu kuning (kolak), bawang putih lumbu putih, krisan pot, tempel, kunyir putih	Lima Puluh Kota	Menengah
	Nurul Kirani/1910213034		Agam	
	Galang Pramoedya/1910212045		Payakumbuh	

Figure 3. The Group Division

3.3. The Guiding Question for Field Experiment

Thomas said in (Wena, 2009) a projected based learning preserved several principles in the implementation one out of which is the Guiding Question [7]. It signifies that the projected job done by the students is sourced from either question or problem guiding them (students) to discover the concept of certain field of discipline. In this case, the job activity becomes an external motivation to the students to build up their independency in completing their assignment. In the lecture of Horticulture, the students are guided measurably by using the experimental design. Therefore, each group has to discuss the guiding questions given by the. The first question is "What is the experimental design to be done?" "What treatment is to be given and what is the treatment grade as well what are the number of repetitions in each single experiment? Such assignment will intensify the ability of student mastery the plant physiological science, agro-climatology, Soil science, manure and fertilizer, experimental design as well as plant production. The group discussion output will be discussed in a classical brainstorming so that a fixed experimental design will be produced (Figure 4)

KELOMPOK : 4
NAMA KETUA KELOMPOK : M. Surya Ramadhana Gusra (1910213016)
NAMA ANGGOTA KELOMPOK :

1. Mutiara Ihsani (1910211010)
2. Azzikril Hakim (1910211047)
3. Linda Putri Yanti (1910212004)
4. M. Surya Ramadhana Gusra (1910213016)

TANAMAN :

5) Terong (*Solanum melongena* L.)
6) Semangka (*Citrullus lanatus* var. Lanatus)
7) Kacang panjang (*Vigna unguiculata* ssp. Sesquipedalis)

(2) **Perlakuan pada Kelompok :**
Perlakuan Komposisi Media Tanam (Tanah : Pupuk Kandang) untuk tanaman Terong
Perlakuan Dosis pupuk NPK untuk tanaman Semangka
Perlakuan Dosis pupuk Kandang untuk tanaman Kacang Panjang

(3) **Taraf Perlakuan masing-masing anggota kelompok**

Perlakuan	Tanaman	Mutiara Ihsani	Azzikril Hakim	Linda Putri Yanti	M. Surya Ramadhana Gusra
Komposisi Media Tanam (Tanah : Pupuk Kandang)	Terong	1 : 1 (3 kali ulangan)	1 : 2 (3 kali ulangan)	2 : 1 (3 kali ulangan)	3 : 1 (3 kali ulangan)
Dosis pupuk NPK	Semangka	80 gr (3 kali ulangan)	100 gr (3 kali ulangan)	120 gr (3 kali ulangan)	140 gr (3 kali ulangan)
Dosis pupuk Kandang	Kacang Panjang	10 ton/ha (3 kali ulangan)	15 ton/ha (3 kali ulangan)	20 ton/ha (3 kali ulangan)	25 ton/ha (3 kali ulangan)

Figure 4. Answer from Guest Questions

3.4. Brainstorming and Evaluating over Student's Learning Motivation

Guarasa said in (Sutirman, 2013) said Project-Based Learning is a student centred strategy would motivate initiation focusing the student on the real world and it could increase their motivation [8]. The teaching staffs are responsible for monitoring over the student's activities during the project completion through a logbook (Figure 5). The monitoring is done by the way of facilitating them in every process. The brainstorming, too, is done live right on the seeding and planting soil so that the PjBL convener could directly check the validity of both data and documentation truths available in ilearn and google classroom. The monitoring will assist the convening team to understand how the project progress and the planting condition are. The brainstorming activity will help the students solve the problems and understand more deeply all sciences related to the plant cultivating activity. The projected progress report is also input into the faculty ilearn followed with the photo of activity.

The brainstorming helps the students find out the seeds and vegetative multiplying materials, manner and criteria of good seeds. The seed could be directly obtained from the farmer, fertilizer kiosk, or on-line shop. It is important for the convening team to see the remarks on the seed expiry on the package or to check it immediately to the farmer or to the seller when the seed was produced. The students, too, should be told how to evaluate the seed. When the seed looks shrunk, and light as well as improper, thus, the seed suspected has been kept too long so that it needs an examination through immersion. When the seed like Chilli, it runs deep into the water, it is still categorized vigour and seed deserved, however, when it afloat on the water it means not deserved to use. When the already sawed seed does not undergo changes in size and does not experience any progress of germination and even on the contrary, it rots thus, it is probably expired seed or it is sawed in inundated condition or it ever underwent water stress a moment prior to the germination so that it already germinated and died.

The seed cannot germinate when there is no imbibition process or have a length of wave of improper sunshine. Such as chilli seed it needs a dark condition to stimulate the germination whereas the cabbage one does not or under the sun-shade. As for the multiplying material from a cutting from Chrysanthemum or Binahong, thus, they need the sunshade in order that the cutting grows well and do not die. Not all of them need sawing thus the students have to understand which seed needs sawing and which one does not. Each seed has its own seed domination solution namely different way of sawing such the one in depth of seed planting, the difference in media choice of sawing, and the difference in maintaining technique such as spraying and sunshade preparation.

The whole group planting the koro nut underwent problems for none of them germinated. This was presumably caused by the already expired seeds. There are several groups obtaining no Chrysanthemum seed, thus, the other one succeeding obtaining the seed were asked for help search for the seed again. There are some groups wrongly chose the multiplying material where the epiphyte Orchid is planted at the polybag as terrestrial Orchid so it must be changed. There are students reading literature that the orchid multiplication through the seed is very hard, therefore, the team recommended to use the young one or just use the bulb. A group underwent a constraint in sawing the Coriander whereas the other managed to saw it. Finally, from the brainstorming it was understood that in sawing the coriander, the seed should not be covered deep into the soil for it causes it to rot. In order to promote the Coriander germination, it is just a little bit pushed under the soil surface. Several groups did not cover the Chilli seed on the sawing land in the first week so that a lot of the seeds did not germinate.

Some groups put cover long enough over the germination that it caused the germination to die or there also gave the sunshade during the sawing so that the germination did not receive the sunshine, as a result, the seed undergoes etiolation and is risking from death at the moment of transplanting. There is a group whose both chilli seed and germination died from a continual immersion due to a long rain. Each student is assigned to multiply vegetation it could be in form of grafting or occulation. In making the grafting and the occulation, it is necessary to pay attention on several items such as the maintenance of lower and lower tree, the choice entress eye and technique as well as maintenance.

Logbook Progres Project

LOGBOOK PROGRES PROJECT

Nama : Mutiara Ihsani
NIM : 1910211010
Mata Kuliah Praktikum : TEKNOLOGI PRODUKSI TANAMAN HORTIKULTURA LANJUTAN
Kelas : AGRO C (Kuliah PjBL)
Dosen Pengampu Mata Kuliah : Prof.Dr.Ir. Warnita, MP; Nilla Kristina, SP. MSc
Dosen Penanggung Jawab Praktikum : Elara Resigia, S.P., M.P.
Kegiatan Minggu Ke : 1

❖ Kegiatan Mingguan

Kegiatan	Tanggal Kegiatan	Dokumentasi Pelaksanaan Kegiatan[1)]	Kendala
Persemaian Tanaman Terong, Tanaman Semangka, dan Tanaman Kacang Panjang Persemaian dilakukan dengan menggunakan egg tray yang diisi tanah Sebelum dilakukan persemaian benih direndam selama ±24 jam agar dormansi pada benih pecah dan memudahkan proses perkecambahan. Setelah benih direndam lalu ditanam pada egg tray yang telah di isi tanah. Sebelum di tanam, tanah	Selasa, 14 September 2021		

Logbook Progres Project

LOGBOOK PROGRES PROJECT

Nama : M. Surya Ramadhan Gusra
NIM : 1910213016
Mata Kuliah Praktikum : TEKNOLOGI PRODUKSI TANAMAN HORTIKULTURA LANJUTAN
Kelas : AGRO C (Kuliah PjBL)
Dosen Pengampu Mata Kuliah : Prof.Dr.Ir. Warnita, MP; Nilla Kristina, SP. MSc
Dosen Penanggung Jawab Praktikum : Elara Resigia, S.P., M.P.
Kegiatan Minggu Ke : 2

❖ Kegiatan Mingguan

Teknik Sambung Pucuk pada tanaman Mangga

Kegiatan	Tanggal Kegiatan	Dokumentasi Pelaksanaan Kegiatan[1)]	Kendala
1. Mengikis ranting pohon mangga utama dengan bentuk segitia	26 September 2021		

Figure 5. Logbook Progress Project

The brainstorming is intended to give the students a chance in making a reflection of learning done either individually or in group. The students need to share both the feelings and the experiences, to discuss what was successful, to discuss what was changed, and to share the ideas oriented to the new enquiry. The brainstorming is the key to promoting the student's ability of soft skill. The lecture motivates the students to speak up, to listen to others, to elicit information, and to try to understand the plant cultivating technique primarily both sawing and planting.

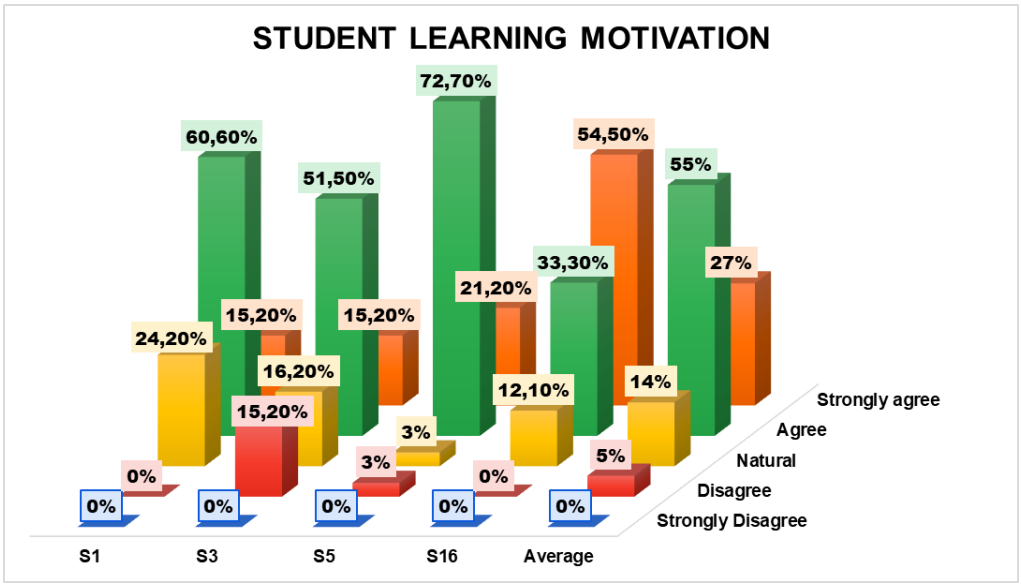

Figure 6. Student Learning Motivation

The indicator showing the success of Project Based Learning might be seen from the student's learning motivation. The chart at Figure 6. shows how the student's motivation resulted from the questionnaire evaluation based upon the question number 1 (S1), that I feel excited to participate in the brainstorming, thus, the result gained is approximately 15,20 % of the students absolutely agreed and 60,60% of the students agreed. Based upon the question number 3 (S3), that I participated and played an active role in the brainstorming then the result obtained as many as 15,20% of students absolutely agreed and as many as 51,50% of students agreed with the statement. Based upon the question number 5 (S5) that I listened to the lecturer's explanation, thus, it was acquired as many as 21,20% students agreed and 72,70% of others agreed with the statement. Based upon the question number 16 (S16) that I tried to follow the brainstorming on time, thus, it resulted 54,50% of students fully agreed and 33,30% of others agreed with the statement. The diagram above shows 55% of the students agree and 27% of them agreed to follow the brainstorming activities. Eventually, we know that the brainstorming in PjBL develops the positive attitude in learning.

4. EVALUATING FIELD EXPERIMENT

The research done on the field experiment is informed systematically, controllably, and done under a scientifically empirical method to obtain objective, valid,

reliable data, to be able to find (describe), predict, test, and control social phenomena in the hope of understanding, anticipating and solving problems in the field researched [9]. Therefore, the field experiment let the students to have best knowledge and skill in plant cultivation.

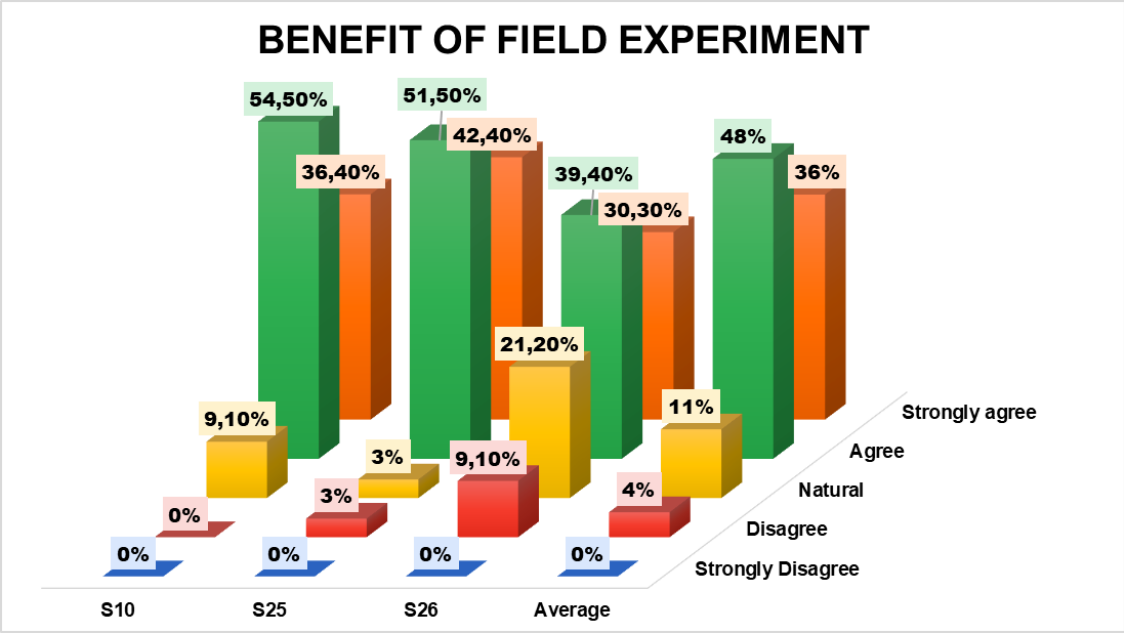

Figure 7. Benefit of Field Experiment

Based upon figure 7, from the question number 10 (S10), I found a new thing to increase the knowledge through the field experiment that it can be concluded that approximately 36,40% of the students absolutely agreed and 54,50% of the students agreed with the statements. Based upon the question number 25 (S25), I acquired a good experience in the field practice under the PjBL method compared to the conventional one, thus, it could be concluded that approximately 42,40% of the students absolutely agreed with the statement and 51,50% of the students agreed with the statement. Based upon the question number 26 (S26), the response is I understand the inside out of both sawing and planting on the field, we found that 30,30% of the students absolutely agreed and as many as 39,40% students agreed with the statement. 48% of the student agreed and 36% of the students did strongly agree that they benefited from field experiment. It means the projected learning helped student understand about the habit of the plant, the concept of cultivation from various plant such as chilli, Cabbage, Garlic, Chrysanthemum, Binahong, Ginger etc.

Sutirman said (2013) it showed that the implementation of Project-Based Learning brought about the benefit mainly to the students: (1) to increase the presence frequency, to grow self-independency, and positive attitude to the learning; (2) to give the equal academic benefit or better than resulted from other model, in which the students involved in the project preserve a bigger responsibility for their own learning; (3) to offer the opportunity to the students to develop the complex skills such high level thinking, to solve the problem, to maintain collaboration and, to communicate; (4) to widen the learning access of the students so that it becomes the strategy in order to involve the students with various cultivations [8].

5. CONCLUSION

The PjBL method in the subject Advanced Horticultural Production Technology is initiated with a project planning and time schedule; analysis of learner characteristics; guiding questions for experimental design; monitoring progress reports, brainstorming and evaluating of the project. The student's learning motivation is calculated based upon several indicators such as the student's seriousness in paying attention upon the lecturer and the concentration as well as participation in the brainstorming. The result showed that the brainstorming in the PjBL grew the positive attitude toward learning. The field experiment might increase both student's knowledge and ability. The students understood better about the plant and cultivation concept from many horticultural plants.

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