

# Capacity Building for Biological Experiment Gardens through Campus Intellectual Product Business Development Program (PPUPIK)

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**Abstract**—Biological experiment garden is one of the work units in the Biology Department FMIPA UNM which functions to support the implementation of lectures, especially the practicum of various courses that are relevant for students majoring in biology. Through the Campus Intellectual Product Business Development Program (PPUPIK), the Biological Experimental Garden has improved its capacity and function, not only as a practicum for biology students but also as a UNM profit unit. PPUPIK is a community service program that provides opportunities for universities to earn income and help create new entrepreneurs. Through the program, the biology experiment garden was revitalized as a center for learning resources and training and was open to all levels of education and the community to be used as a learning resource. Implementation methods include apprenticeship students, demonstrations, mentoring and performance. Through the program, the capacity and function of the experimental garden have expanded and strengthened. Biological experiment gardens receive training, practicum and environmental education services for students, students and the community. The programs developed include training and production of allocations, planting media, liquid organic fertilizers, husk charcoal, hydroponics, verticulture, horticulture, biology practicum, media and learning resources development and livestock. The impact of the PPUPIK program can be seen from various aspects including (1) the experimental garden environment is more organized, (2) the learning facilities / infrastructure are increasing, (3) the use of experimental gardens as a place for research by students and lecturers, has increased, (4) gardens the experiment became a practicum destination for students, students and the community (5) the experimental garden was the destination of comparative studies for domestic and foreign students (6) the apprenticeship process and (7) publicizing and socializing activities.

**Keywords**—PPUPIK, Biological experiment garden

## I. INTRODUCTION

The Biology Experiment Garden is one of the work units under the coordination of the biology department of the Faculty of Mathematics and Natural Sciences (FMIPA) Makassar State University (UNM). The area of the biology experiment garden is 6796.49 m<sup>2</sup>, located on the UNM

Parangtambung Campus Jalan Daeng Tata Raya, Kota Makassar, South Sulawesi, Indonesia.

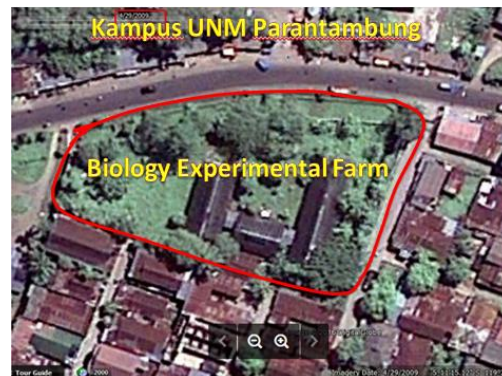


Fig. 1. Location of LKPB FMIPA UNM

Biological experiment gardens have been around since 1982 and have become a subdivision of biological laboratories. Since 2015, the biology experiment garden has become a separate laboratory unit under the coordination of the Biology department. The function of the experimental garden is as a place to conduct practical courses for students of the biology department of FMIPA UNM.

In 2017, the biology experiment garden was trusted by the Ministry of Research and Technology to be involved in the Science and Technology Program for Campus Creativity and Innovation (IbKIK) and in 2018 changed its name to Campus Intellectual Product Business Development Program (PPUPIK). access to the creation of new entrepreneurs, supporting campus autonomy through the acquisition of independent income, providing opportunities for work experience to students, encouraging the development of a culture of utilization of university research results for the community.

The PPUPIK activity in 2018 involved 4 lecturers and 15 students. Implementation methods include apprenticeship students, demonstrations, mentoring, consultation and practical work in various activity units. In order for each activity to take place optimally, the tools and production materials need to be prepared. A number of goods

production activities have been completed with manufacturing manuals, while education services are complemented by student worksheets and practicum guides. For activities that do not have a manual, then consultations with expert lecturers in FMIPA UNM are conducted.

The existence of PPUPIK causes the function of the experimental garden to expand, not only as a practicum for students but also provides learning services for students, students and the community outside the Biology academic community of FMIPA UNM. In the learning process, biology experiment gardens apply constructivist approaches.

Theoretically, constructivist learning must stimulate the development of 'thinking skills and encourage students to be active and rational thinking. The constructivist learning approach also stimulates intrinsic motivation and maintains students' pleasant ways of learning through increased natural curiosity, personal interests, autonomy, novelty, and challenging tasks. Because they are free to think and learn in their own ways, constructivist students tend to be creative. Likewise, the distribution of freedom and knowledge sharing will increase innovation. In addition, students tend to develop metacognition and learning independence because they are able and encouraged to organize their own learning. In the end, students can gain a deep understanding of knowledge and continuous skills development [1].

Dzerviniks & Popiavskis [2] there are eight main principles of constructivism, namely (1) construction, (2) understanding, (3) context, (4) cooperation, (5) communication, (6) responsibility, (7) transfer, and (8) emotional experience [2]. The eight principles are very relevant to be applied in learning in biology experimental gardens. Bas [3] suggests that constructivist learning is based on the active participation of students in problem-solving, critical and creative thinking.

## II. IMPLEMENTATION METHOD

Capacity Building for Biological Experiment Gardens at FMIPA UNM through Campus Intellectual Product Business Development Program (PPUPIK). This program is a planned two-year program from 3 years. PPUPIK implementation methods include apprenticeship students, mentoring, demonstrations and performance or practical work. The types of activities developed are equipped with manuals, both in the form of student worksheets (LKPD) and practical and training guides. Data collection is done through observation methods, questionnaires, and data recapitulation during program implementation. Data analysis was carried out descriptively.

## III. RESULTS AND DISCUSSION

### A. Implementation results

#### 1) Experimental Environmental Management

Through the PPUPIK program, the biology experiment garden is becoming more organized. This arrangement is important in order to provide services to service users. The arrangement of the experimental garden environment includes front yard arrangement, procurement of gates, garden settings, main yard arrangement, drainage cleaning, land preparation for various types of student lab work.

The arrangement of the front yard and yard aims to beautify the appearance of the garden and as a place to display the products produced by the garden. Besides that, students are also used for various types of entrepreneurial activities. On the main yard, a garden with seating is developed that can be used by students to study and relax. On the main page are also displayed various types of hydroponic products, verticulture and various types of ornamental plants.

#### 2) Management of Learning Facilities / Infrastructure

Through PPUPIK activities, the learning infrastructure of begin is well organized. Learning infrastructure at the experimental garden is presented in Table 1.

TABLE I. EXPERIMENTAL GARDEN INFRASTRUCTURE

Learning Infrastructure	Area (m <sup>2</sup> )
Greenhouse	8.47 x 20.17
The garden hall	8.47 x 32.00
Aquaculture	8.47 x 12.55
Compost house	8.00 x 9.57
Garden house	7.76 x 9.76

The greenhouse is not only used as a place for practicum but also functions as a place to develop horticultural crops, especially ornamental plants, object visits for students and students and training places. The experimental garden hall has expanded its function as simple constructivist-based learning the place. Through PPUPIK activities, experimental gardens develop various media and learning resources that can be used in learning (Table 2).

TABLE II. LEARNING FACILITIES IN EXPERIMENTAL GARDENS

Learning Infrastructure	Amount
Chicken frame	6 pieces
Fish frame	3 pieces
Mini ecosystem	20pieces
Hydroponic	10 pieces
Hidroakuameubel	1 piece
Aquaponic in the room ( <i>indoor</i> )	1 piece
Vertikulture	20 pieces
Animal anatomy	30 pieces
Specimens of moss	28 pieces
Specimen of Echinodermata	30 pieces
Mollusca Shell Specimen	200 pieces
Arthropod specimens	30 packet
Model protein synthesis	3 pieces

In the Hall section, there are 4 spaces measuring 4x 4 m. 2 functions as an office, 1 functions as a pet house and 1 as a warehouse.

### B. Use of experimental gardens as research sites

The impact of PPUPIK on strengthening the capacity and function of experimental gardens is an increase in research activities in the experimental garden environment. A number of studies conducted in the experimental garden are shown in Table 3.

**TABLE III. NUMBER OF LECTURER RESEARCH / SERVICE IN THE EXPERIMENTAL GARDEN**

Year	Lecture research	Devotion	Student Research	Student Creativity Program (PKM)
2017	4	4	8	3
2018	5	3	12	3

The title of the lecturers' research are (1) the development of electric metal propellers for the application of Mendell's law and its deviations in high school, (2) antifertility activity test of methanol extract of Tapak Dara leaf (*Catharanthus roseus*) in mice (*Mus Musculus*) ICR Male, (3) Vegetable fungicide formulation made from phenolic content of cocoa plants for fusarium wilt control in Tomato (*Solanum lycopersicum L.*) plants in South Sulawesi.

While the title of the Student Creativity Program include: (1) Synthesis of Briquette Fuel Based on Durian Skin Waste and Coconut Shell Charcoal as an Alternative Energy Source, (2) Utilization of Ketapang fruits (*Terminalia catappa L.*) as a Food Preservative Material., (3) Development of Hydroponic-Verticulture learning tools through 3 factor analysis for Class X SMA / MA.

### C. Practicum /training visits

In the book America's Lab Report [4] Investigations in High School Science (2006) laboratories have been recognized to promote a number of goals for students, although this target inventory varies somewhat, a core set remains fairly consistent. Based on these general objectives, the laboratory staff developed a comprehensive target list for or desired results from laboratory experience :

1) *Improve mastery of subject matter.* Laboratory experience can increase students' understanding of certain scientific facts and concepts and the ways in which these facts and concepts are organized in scientific disciplines.

2) *Develop scientific reasoning.* Laboratory experience can improve students' ability to identify questions and concepts that guide science

PPUPIK's activities in the biology experiment garden improved the capacity and function of the garden in various aspects including (1) the experimental garden became a biological practicum for elementary, middle, high school and students from other universities. Practical topics include vegetative and generative breeding, animal and plant diversity, photosynthesis, horticulture, ecosystems, respiratory system, food digestive system, genetics, and cell development. Training topics included making bokashi, liquid organic fertilizer, husk charcoal, planting media, hydroponics, and verticulture.

In the two years of PPUPIK implementation in the biology experiment garden, the number of visitors / users is presented in Table 4.

**TABLE IV. A NUMBER OF VISITORS / USERS OF THE PLANTATION BIOLOGY**

School/Institution	2018	Destination
Kindergarten	36	Environment learning
Elementary school	300	Practical work
Junior High school	1000	Practical work
Senior High school	633	Practical work
Student in university	102	Practical work
Teacher	217	Training

### D. Comparative study

The existence of the PPUPIK program makes the garden a biological experiment as an object of comparative study for students, teachers, and lecturers. The number of comparative studies is presented in Table 5

**TABLE V. THE NUMBER OF COMPARATIVE STUDIES IS PRESENTED**

Origin of Visitors	2017/2018	Destination
Universiti Teknologi Malaysia	25 people	Practical work
Tarlac Agricultural University (TAU) Philippines	10 people	Practical work
Roosevelt College Institute (RCI) Philippines	2 people	Practical work
Saint Mary's University Philippines	1 person	Practical work
Far Eastern University (FEU) Philippines	1 person	Practical work
Ateneo de Naga University (ADNU) Philippines	1 person	Practical work
Valaya Rabajat University Thailand	1 person	Practical work
Chiang Mai dan Chiang Rai University Thailand	5 people	Practical work

### E. Student apprenticeship

Jennifer Bay [5] one reason that the exploration and understanding of organizational culture is such an important part of internship course and by the time they graduate from college, many students are, arguably, fairly schooled in how the university works. In addition, Students have learned how to work the system, as well as how to communicate and interact with a variety of departments and groups of people on campus.

Students who are apprenticed are students of biology at FMIPA UNM. Student apprenticeship is carried out in relation to PPUPIK activities. Apprenticeship is carried out on (1) the production process, (2) horticulture cultivation, (3) chicken farms, and (4) practicum visits, training and learning services. Apprenticeship production processes include (a) production of allocations, (b) production of planting media, (c) production of liquid organic fertilizers, (d) production of husk charcoal, (e) production of hydroponic installations, (f) production of verticulture installations. Horticultural cultivation includes (a) cultivation of succulent plants, (b) *aloe vera*, (c) *Anthurium*, (d) *Sansiviera*, (e) *Adenium*, (f) and various other types of ornamental plants. Besides that, apprenticeship is also carried out related to the connection. Apprenticeship of chicken farms is carried out in order to support the production of fertilizers. Practical visit services and training services include environmental education, practicum visits, and training at various levels of education.

#### F. Publication and socialization

Publication is done on online and offline media. Online is done through the official website of the experimental garden with the address <http://lkpbumm.com>. In addition, publications are also carried out through online media such as [tribunnews.com](http://tribunnews.com), and [infosusel.com](http://infosusel.com) / and offline through the daily dawn newspaper.

In order for the experimental garden activities to be known to the public, in addition to publications in the media, the experimental gardens were also actively participating in various exhibitions including: Educational exhibition to welcome national education day in May 2018, an exhibition to welcome the 57th Anniversary of UNM in August 2018, and an exhibition of science techno cooperation with trans studio which took place on August 13 to August 31 2018.

#### IV. CONCLUSION

PPUPIK activities can increase the capacity and function of the garden of biological experiments MIPA UNM. Capacity building and function of experimental farms through (1) structuring of experimental garden environments (2) structuring learning facilities / infrastructure, (3) utilizing experimental gardens as research sites for students and lecturers, has increased, (4) experimental gardens being practicum destinations for students, students and the community (5) the experimental gardens are the aim of

comparative studies for domestic and foreign students (6) the apprenticeship process and (7) Conducting publications and socializing activities.

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#### REFERENCES

- [1] T. Haruthaihanasan, "The Effects of Experiences with Constructivist Instruction on Attitude toward Democracy among Thai College Students," University of Missouri, 2010.
- [2] D. J. & P. J., "Acquisition of physics in comprehensive school: accents of constructivism approach," in *Problems of education in the 21 century volume, 41*, 2012, pp. 10–17.
- [3] G. Bas, "Investigating the Correlation Between Students' Perceptions on the Constructivist Learning Environment and their Academic Success in Science Course with Path Analysis," *J. Balt. Sci. Educ.*, vol. 11, no. 4, pp. 367–379, 2012.
- [4] A. L. R. I. in H. S. Science, "Chapter Skim The National Academies of Sciences, Engineering, and Medicine 500 Fifth St. N.W.," Washington, D.C. 20001, 2006.
- [5] B. Jennifer, "Preparing Undergraduates for Careers: An Argument for the Internship Practicum," *Coll. English (Published by Natl. Council. Teach. English)*, vol. 69, no. 2, pp. 134–141, 2006.